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CACHE CREEK BASIN

California

STANDARD PROJECT FLOODS

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

OFFICE REPORT
CACHE CREEK BASIN, CALIFORNIA
STANDARD PROJECT FLOODS

HYDROLOGY

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OFFICE REPORT

SUBJECT: Cache Creek Basin, California, Standard Project Floods

1. Purpose. The purpose of this report is to present for approval standard project floods computed for streams at selected index points in Cache Creek Basin. Criteria and procedures used in developing the standard project floods are outlined and described in this report.

2. Plan of improvement. The general plan of improvement consists of enlarging the Clear Lake outlet channel capacity, increasing the channel capacity in lower Cache Creek between Capay and the settling basin, and control of the sediment problem. See chart 1.

3. Location and description of the basin. Cache Creek Basin is located about 110 miles northeast of San Francisco in the coastal mountain ranges. Its predominant feature is Clear Lake, the largest natural body of fresh water entirely within the State of California. Cache Creek and its principal tributaries, North Fork Cache Creek, Bear Creek and Clear Lake drain about 1,139 square miles of area. Lakeport Lake project, presently authorized, and the Indian Valley Reservoir, presently under construction, are considered as existing features in this study. See chart 1. The outlet of Clear Lake is the origin of Cache Creek, which flows in a generally northeasterly direction about 8.5 miles to the confluence with its North Fork, and then in a southeasterly direction through Wilson Valley to the confluence with Bear Creek. Cache Creek continues through Capay Valley in a southerly direction to the irrigation dam at Capay, and then into the Sacramento Valley near Yolo. Stream profiles are shown on chart 2.

The topography of the basin varies from steep, rugged, densely vegetated hillslopes of the Coast Ranges to the gentle slopes of the valley floor near Capay, located on the western edge of a large alluvial plain. Elevations range from 6,120 feet at Goat Mountain on the northern basin perimeter to about sea level near Yolo. See chart 3.

The geology of the basin consists of the Franciscan formation which forms the core of much of the Coast Ranges. Rock out-crops of this formation can only be found in the upper part of Cache Creek Basin and consist of marine sedimentary and volcanic rock. To the east of Clear Lake and in the central portion of the basin, rocks are predominantly of massive sandstone with imbedded conglomerates and silty shales. Continental deposits in the lower portion of the basin consist of silt-clay, sand, and gravel, and occur as discreet units and heterogenous mixtures. The younger overlying alluvium is similar and generally not as coarse as the continental deposits. Underground aquifers underlie the valley

portion of the basin downstream from Rumsey. The size and extent of these aquifers are not known.

Intensive agriculture, and to a lesser degree the seasonal recreation industry, comprise the main economic features of the basin. State Highways 16, 20, 29 and 53 are the main traffic arteries and are shown on chart 1.

4. Flood control features.

a. Primary features. The Middle Creek Project, under provisions of the Flood Control Act of 1954, consists of levee and channel improvements on Middle and Scotts Creeks and a diversion channel from Clover Creek to Middle Creek near the town of Upper Lake. Lakeport Lake and downstream channel improvements were authorized for construction by the Flood Control Act approved on 27 October 1965. Two flood detention structures, the Highland Creek and Adobe Creek Dams, and five miles of channel improvements below the dams were constructed under Public Law 566. The Indian Valley Reservoir is presently being built under the provisions of Public Law 984 by the Yolo County Flood Control and Water Conservation District. A sediment settling basin at the mouth of Cache Creek was completed in 1937. Levees between Yolo and the settling basin were completed in 1943 and enlarged in 1961. The settling basin and levees were built as units of the Sacramento River Flood Control Project. All existing flood control features are shown on chart 1.

b. Miscellaneous features. Clear Lake is partially regulated by a gated dam completed in 1915. Small irrigation diversion dams feeding numerous irrigation canals in the lower Cache Creek Basin are located near Capay.

5. Projected land use. Present and projected (year 2020) land uses are shown on chart 4 and chart 5. Future land use maps for Lake and Colusa Counties were prepared by these counties; projections for Yolo County were estimated because a general plan for this county is not available. The maps show agricultural, recreational, residential, commercial and industrial areas. Agricultural areas include orchards, vineyards and field crops on the valley floor and grazing lands in the mountains and foothills. Land use projections indicate increases in farm area and recreation-residential area at population centers and around Clear Lake, and a decrease in grazing area. Residential lots would probably be relatively large with access provided by narrow paved lanes. No extensive sidewalk or storm sewer systems are anticipated except in large communities. Commercial use would be limited to various businesses to supply needs of permanent and temporary residents. At present the industrial uses in the basin mostly consist of support

industries for agriculture and the gravel operations near Kelseyville, and between Capay and Yolo. Small industrial reserves would be set aside for future development. The percentages of total area for present and projected land uses are tabulated below.

Land Use	Present Condition (Percent of Area)	Project Condition for Year 2020 (Percent of Area)
Central commercial	0.1	0.3
Industrial	-	0.1
Recreational-residential	1.6	4.0
Intensive agricultural	10.0	12.8
Scenic corridors	-	4.8
Grazing area	88.3	78.0
	100.0	100.0

The present population in Cache Creek Basin is about 22,200. The largest community is the city of Lakeport with a population of 3,200. The remaining population is located in and around the communities Nice, Lucerne, Glenhaven, Clear Lake Oaks, Clear Lake Highlands, Lower Lake, Kelseyville, Rumsey, Brooks, Capay and Yolo. The city of Woodland and the community of Madison are located outside the hydrologic boundaries.

6. Climate. The climate of the Cache Creek Basin is characterized by cool wet winters and hot dry summers. Temperatures range from slightly below freezing in winters to highs of over 100 degrees Fahrenheit at times during the summer. The climatological stations "Lakeport, Clear Lake Highlands, and Brooks Farnham Ranch" are representative of the lower Cache Creek watershed. The following tabulation shows the average monthly temperature and precipitation at those stations:

Station	Lakeport Elev. 1347 ft.		Clear Lake Highlands Elev. 1365 ft.		Brooks Farnham Ranch Elev. 294 ft.	
Period of Record(yr)	27	71	9	18	45	51
Month	Ave. Temp. F°	Ave. Precip. in.	Ave. Temp. F°	Ave. Precip. in.	Ave. Temp. F°	Ave. Precip. in.
Jan	41.2	6.18	41.8	5.85	44.8	4.06
Feb	46.7	4.90	45.0	4.46	48.5	4.10
Mar	53.7	3.36	48.1	2.13	52.9	2.63
Apr	52.4	2.03	51.5	1.84	58.2	1.31
May	61.7	0.88	60.2	0.50	65.3	0.60
Jun	69.8	0.45	67.3	0.19	72.4	0.20
Jul	75.0	0.04	73.5	0.01	78.4	0.01
Aug	74.8	0.05	73.3	0.17	75.8	0.02
Sep	65.3	0.24	66.5	0.37	72.1	0.19
Oct	56.7	1.74	57.5	1.29	63.4	0.96
Nov	47.2	2.88	48.6	3.35	52.6	1.75
Dec	38.4	5.87	41.4	4.61	46.0	4.17
Annual	56.9	28.52	56.2	24.77	60.9	20.00

As indicated on chart 6, normal annual precipitation varies from a maximum of more than 60 inches in the upper portion of Kelsey Creek to a minimum of about 17 inches near the community of Yolo, and averages about 32 inches over the watershed. The major portion of the annual rainfall occurs during the October to April period. Snowfall is very rare and has no significant effect on the streamflow in the basin.

7. Runoff. Drainage area, average annual runoff and lake stage for the period of record for pertinent gaging stations are listed in the following tabulation:

Location	Drainage Area (sq. mi.)	Years of Record	Length of Record (year)	Average Annual Runoff (ac-ft)
Clear Lake at Lakeport	528	1913-1972	59	5.00 1/
Cache Creek nr. Lower Lake	528	1944-1971	28	253,600
North Fork Cache Creek near Lower Lake	197.0	1930-1971	42	142,000
Bear Creek near Rumsey	100.0	1958-1971	14	33,250
Cache Creek above Rumsey	955.0	1965-1971	7	560,000
Cache Creek near Capay	1,044.0	1942-1971	30	478,200
Cache Creek at Yolo	1,139.0	1903-1971	69	379,600

1/ Average annual lake stage in feet above datum of gage, 1,318.65 ft.

8. Major floods. All major floods in the Cache Creek Basin have resulted from general rainstorms. Local cloudburst storms have not produced any major recorded events. The following tabulation shows the name of gaging station, date, mean daily lake stage, peak flow, and three-day volume for the largest recorded floods at each pertinent gaging station:

Gaging Station	Flood Date	Maximum Lake Stage (ft.)	Peak Flow (cfs)	3-Day Volume (ac-ft)
Clear Lake at Lakeport	27 Feb 58	10.88	-	-
	22 Dec 64	4.10 1/	-	-
	8 Jan 65	9.10	-	-
	23 Jan 70	10.47	-	-
Cache Creek nr. Lower Lake	24 Feb 58	-	8,000	30,550
	22 Dec 64	-	5 1/	
	5 Jan 65	-	5,320	23,270
	23 Jan 70	-	6,320	26,620
North Fk. Cache Creek nr. Lower Lake	24 Feb 58	-	13,500	31,860
	22 Dec 64	-	19,700	61,800
	5 Jan 65	-	15,700	40,060
	23 Jan 70	-	16,000	37,410
Bear Creek near Rumsey	22 Dec 64	-	6,820	10,680
	5 Jan 65	-	9,720	12,710
	23 Jan 70	-	5,900	10,400
Cache Creek above Rumsey	5 Jan 65		59,000 2/	-
	24 Jan 70	-	43,400 2/	99,970
Cache Creek near Capay	24 Feb 58	-	51,600	98,980
	23 Dec 64	-	32,400	84,350
	5 Jan 65	-	44,500	96,620
	24 Jan 70	-	36,200	92,230
Cache Creek at Yolo	25 Feb 58	-	41,400	102,230
	23 Dec 64	-	26,200	79,360
	6 Jan 65	-	37,800	97,420
	24 Jan 70	-	34,600	97,730

1/ Value is concurrent to values at other stations for the same flood.
2/ Value appears unreasonably high, due to the extension of low flow rating table.

9. Analysis of storm-runoff relationship. A study of precipitation and runoff data for the major floods in Cache Creek Basin indicated that reliable data were available only for the December 1964, the January 1965, and the January 1970 floods. Hydrographs for these floods are shown on charts 7 through 11. Runoff data used were recorded at the following gaging stations:

1. Clear Lake at Lakeport
2. Cache Creek near Lower Lake
3. North Fork Cache Creek near Lower Lake
4. Bear Creek near Rumsey
5. Cache Creek above Rumsey (January 1970 only)
6. Cache Creek near Capay
7. Cache Creek at Yolo.

Available precipitation data included information from hourly recording stations and several nonrecording stations in and around Cache Creek Basin. The location and description of these stations are shown on chart 6.

a. Subdivision of watershed areas. For hydrologic analysis, the basin was divided into 10 representative subareas as shown on chart 12.

b. Storm analysis. Basin mean precipitation amounts for the 1964, 1965, and 1970 storms were estimated from isohyetal maps shown on charts 13, 14 and 15. Time distribution for the storm amounts was based on Mahnke, Potter Valley 3SE, Clear Lake Highlands and Brooks Farnham Ranch rainfall records. One-hour hyetographs for the 1964, 1965 and 1970 storms are shown on charts 7 and 8.

c. Baseflow. Baseflow used in the reproductions of the 1964, 1965 and 1970 floods on North Fork Cache Creek near Lower Lake and Bear Creek near Rumsey are shown on charts 7 and 8. It was estimated to be equal to the flow at the beginning of the floods, increasing uniformly until it intercepted the extension of the recession limb of the observed hydrographs. Baseflow could not be determined accurately for the gages at Rumsey, Capay, and Yolo since high sustained outflows from Clear Lake combined with a substantial rate of seepage into aquifers in this portion of Cache Creek Basin tend to obscure the actual baseflow.

d. Unit hydrograph analysis. The basic procedure used for developing unit hydrographs in this report is outlined in the Department of the Army's Technical Bulletin 5-550-3, "Flood Prediction Techniques," and in the Corps' Engineering Manual 1110-2-1405, "Flood Hydrograph Analyses and Computations." This procedure involves use of physical dimensions of the basin measured from topographic maps, an estimated average channel and basin hydraulic factor ($\bar{n}$) obtained by field observation, lag relationships, and summation curves (S-curves) obtained from unit hydrographs developed from reproduction of recorded floods.

The unit hydrographs for the areas above the North Fork Cache Creek near Lower Lake and Bear Creek near Rumsey gages, shown on charts 16 and 17, were derived from floods shown on charts 7 and 8. These unit hydrographs have computed lag values of 11.05 and 7.46 hours respectively. The S-curve shown on chart 18 was developed from these unit hydrographs. It was concluded that the lag relationship together with the S-curve could be used for developing synthetic unit hydrographs for use in computing standard project floods. The lag relationship is shown on chart 19. The following tabulation shows the pertinent data applicable to the developed synthetic unit hydrographs. Sample SPF unit hydrographs are shown on charts 20 and 21, and ordinates of all subarea SPF unit hydrographs are tabulated on table 1.

Subarea	D.A. (sq. mi.)	L (mi)	Lca (mi)	S (ft/mi)	$\frac{LLca}{S^{1/2}}$	$\bar{n}$	LAG (hrs)
Copsey Creek near Lower Lake Index Point 2	13.20	6.37	2.27	125.59	1.30	0.10	2.65
Cache Creek Local between Index Points 3 and 2, 1	10.76	5.94	3.13	111.12	1.77	0.10	2.99
North Fork Cache Creek - Indian Valley Res. Index Point 4	121.00	27.22	13.83	107.46	36.30	0.06	5.64
North Fork Cache Creek Local between Index Points 5 and 4 North Fork Cache Creek nr. Lower Lake	76.00	17.62	8.35	179.63	10.98	0.06	3.58
Bear Creek near Rumsey Index Point 6	100.00	31.18	13.77	72.17	50.52	0.06	6.40
Cache Creek Local between Index Points 7, and 6, 5 & 3 Cache Creek above Rumsey	127.30	31.72	16.05	66.84	62.24	0.06	6.92
Cache Creek Local between Index Points 8 and 7 Cache Creek near Capay	91.70	24.73	11.06	100.89	27.22	0.06	5.06
Cache Creek Local between Index Points 9 and 8	34.30	11.71	7.59	243.39	5.70	0.06	2.79
Cache Creek Local between Index Points 10 and 9 Cache Creek at Yolo	60.70	24.73	16.70	62.68	52.14	0.06	6.47

e. Loss analysis. An examination of storm hyetographs and flood hydrographs indicated that reasonable reproductions of historical events could be made by assuming there would be no excess until initial and uniform loss requirements are satisfied. After several trials for the 1965 and 1970 storms, which fell on wet ground, uniform loss rates of 0.064, 0.04 and 0.030 inches per hour were adopted for North Fork Cache Creek, Cache Creek local above Rumsey and Bear Creek, and Cache Creek below the Rumsey gage respectively. In comparison a uniform loss rate of 0.061 in/hr was used for Adobe, Kelsey and Cole Creeks in previous studies.

In the lower portion of Cache Creek Basin, between Rumsey and Yolo, floodwater have been estimated to percolate into alluvial aquifers at the following rates:

Flow at Yolo in cfs/hour	Seepage in cfs/hour
2,000	510
3,000	670
5,000	850
10,000	1,220
20,000	1,740
70,000	3,290
90,000	3,780

One-hour storm increments were applied in all flood reproductions. The change of land use from present conditions and those projected for the year 2020 (paragraph 5) have little significant effect upon the overall loss rates. Information in support of this conclusion is summarized in a tabulation showing portions of area affected by changed conditions and the effect of these changes on loss rates.

Land Use	Percent of Basin Affected	Effect on Loss Rates
Scenic corridor	5	None
New agricultural	3	Small increase
New additional residential	2	Small decrease
New commercial and industrial	1	Large increase
Unchanged area	89	None

10. Standard project storm. The standard project general-storm precipitation was computed in accordance with procedures outlined in the Sacramento District's revised (1971) "Standard Project Rain-Flood Criteria." Storm precipitation was assumed to occur as rain on snow-free ground. A standard project storm, centered over the drainage area above Indian Valley Reservoir, was selected from several centerings investigated because it produced the most critical flood in the lower Cache Creek Basin. Concurrent storm amounts were calculated for the other subareas. The drainage area of the Clear Lake watershed near Lower Lake was considered as a single area. The following tabulation shows data used in developing the standard project storm (S.P.S.) and concurrent storm (C.S.) for each subarea.

Subarea	Storm Type	D.A. (sq mi)	NAP (in)	Storm Amount (in)
North Fork Cache Creek - Indian Valley Reservoir Index Point 4	SPS	121.0	41.3	18.54
North Fork Cache Creek Local between Index Points 5 and 4	1. C.S.	76.0	35.5	15.64
Clear Lake at the riffles Index Point 1	2. C.S.	504.0	32.7	15.06
Copsey Creek near Lower Lake - Index Point 2	3. C.S.	13.2	30.9	14.51
Cache Creek Local between Index Point 3 and 2, 1	4. C.S.	10.8	27.0	11.76
Bear Creek near Rumsey Index Point 6	5. C.S.	100.0	29.9	11.45
Cache Creek Local between Index Points 7 and 6, 5, 3	6. C.S.	127.3	29.0	11.33
Cache Creek Local between Index Points 8 and 7	7. C.S.	91.7	25.9	10.07
Cache Creek Local between Index Points 9 and 8	8. C.S.	34.3	27.7	10.44
Cache Creek Local between Index Points 10 and 9	9. C.S.	60.7	18.7	4.78

11. <u>Standard project floods</u>. Standard Project Floods were synthesized at the ten index points in Cache Creek Basin by using standard project storms, unit hydrographs, base flow and loss rates discussed in the preceding paragraphs. Component flood hydrographs for the various subareas were routed downstream--using the "Tatum" routing method--assuming flows are contained in channel, and combined at pertinent index points. The SPF-hydrograph at Yolo reflects the loss of overbank flows below Capay, as well as estimated losses into the aquifers in Capay Valley and between Capay and Yolo. All standard project floods take into account existing basin conditions plus the effects of Lakeport Lake and Indian Valley Reservoir. Standard project and concurrent flood hydrographs are shown on chart 22. Pertinent standard project storm and flood data are tabulated as follows:

Index Point No.	Location	Subarea Hydrographs						Combined Hydrographs		
		Precip (in)	Losses (in)	Excess (in)	Baseflow (in)	Peak (cfs)	Peak (csm)	Peak (cfs)	Peak (csm)	8-Day Volume (ac-ft)
1	2	3	4	5	6	7	8	9	10	11
1	Clear Lake at Riffles (Lake stage), (outflow)	15.06				(12.61)		73,000 6,300	154 -	291,830 79,560
2	Copsey Creek nr Lower Lake	14.51	3.38	9.13		3,450	261			
3	Cache Creek Local at Dam	11.76	5.32	6.44		2,100	195			
4	North Fk. Cache Creek at Indian Valley Res. (outflow)	18.54	6.15	12.39		30,200 (13,840)	250			
5	North Fork Cache Cr. Local at gage nr Lower Lake	15.64	6.05	9.59	3.49	18,800	247	20,500	104	127,370
6	Bear Creek nr Rumsey	11.45	3.94	7.51	1.31	14,600	146			
7	Cache Creek Local above Rumsey	11.33	3.87	7.46		17,800	140	50,800	53	304,900
8	Cache Creek Local nr Capay	10.07	2.97	7.10		13,000	142	58,000	56	337,860
9	Cache Creek Local at Div. Dam Nr. Esparto	10.44	3.08	7.36		6,480	189			
10	Cache Creek Local at Yolo	4.78	2.88	1.90		3,270	55	47,180 1/	48	287,480 1/

1/ Magnitude influenced by percolation and/or overbank flow.

12. Frequency analysis. The flow and stage frequency analysis has been confined to general rain floods since all significant floods in Cache Creek Basin have resulted from this type of flood. Peak and volume frequency curves were developed for the following five index points:

Station	Index Point
North Fork Cache Creek near Lower Lake	5
Bear Creek near Rumsey	6
Cache Creek above Rumsey	7
Cache Creek near Capay	8
Cache Creek at Yolo	10

These frequency curves are based on historical flow data and reflect existing conditions (see chart 23). The USGS gage above Rumsey, having a short period of record, was correlated with flow data at North Fork and Capay. This correlation suggests that the increase in peak flow between the North Fork gage and the Rumsey gage appears to be high. The results indicated that the peak flow values obtained from an extrapolated low flow rating curve at Rumsey were not consistent with normal increase in peak flow associated with an increase in area. The large decrease in peak flow between Rumsey and Capay is also inconsistent with the storage and channel characteristics in this reach. Another check was made between thé peak flow and the 1-day volume frequency curve ratios at all the gaging stations. The results indicate that the recorded peak flow values should be reduced by a percentage which closely approximates the ratios obtained at the Capay gage. These adjusted values were then correlated with the Capay record to extend the Rumsey record back to 1943.

Substantial seepage losses into an aquifer do occur between Rumsey and Capay. A comparison of flow data at Capay and Yolo indicates a combination of losses due to seepage into an aquifer between Capay and Yolo and overbank flows near Woodland. Floods go overbank and flow into Willow Slough, south of the community of Madison when flows are larger than 37,000 c.f.s. The overbank flows are increased further by backwater from the Interstate Highway Bridge at Yolo if discharges are larger than 50,000 c.f.s. at the constriction. These conditions are reflected in the rain flood frequency curves at Capay and Yolo.

A maximum annual stage frequency curve was derived for Clear Lake based on maximum daily lake stage records at Lakeport (1914-1972) and a lake stage of 13.3 feet resulting from a computed SPF centered above Grigsby Riffles. Stage data prior to the inception of the Gopcevic Court Decree in 1920, which stipulates the limits of operation of Clear Lake, were adjusted to the requirements of the decree. This stage frequency curve is shown on chart 24, sheet 1. Peak flow frequency curves,

reflecting the previously described preproject conditions, were developed for Cache Creek at Rumsey, Capay and Yolo. These curves are shown on chart 24, sheets 2, 3 and 4.

13. Sedimentation.

a. Suspended sediment load. For this analysis, the Cache Creek Basin was subdivided into four basic geological areas. First, the area above the Grigsby Riffles including Clear Lake and its surrounding watershed. Second, the area between the Riffles and Clear Lake Dam comprising Seigler and Copsey Creeks and the local area above Clear Lake Dam. Third, the drainage area between the gaging station, Cache Creek above Rumsey, and Clear Lake Dam. Fourth, the lower section of Cache Creek Basin between Rumsey and Yolo. All available sediment data published by U.S.G.S. were utilized in estimating average annual sediment discharges.

(1) Clear Lake above Grigsby Riffles. Most sediments transported into Clear Lake are trapped except for a portion of fine colloidal material which is held in suspension together with algae organisms. The mean annual suspended sediment discharge at the Riffles is about 41,000 tons, or about 52 percent of the mean annual sediment discharge measured at the gaging station. This value was based on the difference between the mean annual suspended sediment estimated at Cache Creek near Lower Lake gage and the amount of sediment estimated for Seigler and Copsey Creeks.

(2) Cache Creek above Clear Lake Dam. The discharge of sediments of the Seigler Creek and Copsey Creek watersheds originates from a layer of marine deposits and coarse alluvium, which covers lower portions of this watershed, and from bank erosion on the main stem of Cache Creek. The total average annual sediment discharge from this drainage area was estimated to be 37,100 tons or 48 percent of the mean annual sediment discharge measured at the gaging station. This figure was based on a drainage area-normal annual precipitation ratio between the Seigler Creek and Copsey Creek watershed, and North Fork Cache Creek near Lower Lake. This ratio was then applied to the average sediment discharge per square mile at North Fork Cache Creek near Lower Lake, and multiplied by the local drainage area.

(3) Cache Creek above Rumsey. North Fork Cache Creek drains a region in which rock out-crops of the Franciscan Formation can be found. This formation is relatively shallow and consists of sandstones, shales and chert. Between the Indian Valley Dam and the gage on Cache Creek above Rumsey, the stream flows through an alluvial valley. Pliocene and Pleistocene deposits are drained in this area and probably

yield much sediment. These deposits range from alternating layers of silt-clay, sand and gravel to heterogenous mixtures of sediment.

From a drainage area-normal annual precipitation ratio, it was estimated that about 69 percent of the flow at the gage on North Fork Cache Creek near Lower Lake originates from the area above the Indian Valley Dam. The trap efficiency of Indian Valley Dam was estimated to be 96 percent, which implies that only fine colloidal material will be discharged from the dam. Therefore, it is estimated that with Indian Valley Dam in operation the sediment load at the gage will now be about 30 to 35 percent of the previous (natural condition) sediment discharge.

In its upper reaches, Bear Creek flows through an alluvial valley which is about 10 miles long, and 1 mile wide. The gradient is generally gentle and apparently accounts for the fact that the sediment yield of this valley is rather low as compared to North Fork Cache Creek. Below the alluvial valley, Bear Creek and its tributaries drain primarily lower Cretaceous marine rocks. These foundations are easily erodible and provide large amounts of sediment transport during high and low flow stages.

(4) Cache Creek above Yolo. Below the gage on Cache Creek above Rumsey the stream flows through sedimentary rock formations, which are predominantly sandstone, before entering the alluvial plains of Capay Valley. In places the channel touches bedrock. Precipitation in this reach is much lower than in the highlands, resulting in a corresponding decrease in vegetation, leaving hillsides more susceptible to erosion. A considerable amount of sediment is generated by bank erosion in this reach. The sediment yield of Capay Valley between Rumsey and the Capay sediment station is approximately two times higher than in the upstream portions of Cache Creek Basin. The greater sediment yield is caused by a combination of conditions, like-surficial slump and creep, land cultivation, and a decrease in vegetation, rather than the normal increases in sediment rate due to increased drainage area and stream discharge.

Below the sediment station at Capay, small dams and artificial controls divert surface flow from Cache Creek. Due to a widening of the stream cross-section, flatter stream slopes, and a consequent decrease in velocity, aggradation rather than degradation is the predominant process; therefore, a considerable portion of all sediments discharged at Capay are deposited on the alluvial plain below Capay. Velocities increase again above Yolo and channel degradation will result.

b. Bedload. The bedload discharge was estimated from observations made by U.S.G.S. at the sediment station at Yolo and found to be an

average of 7 percent of the total sediment load for all particle sizes greater than 0.10 mm. This percentage was assumed to be valid for the Cache Creek Basin below Capay Diversion Dam.

c. Quantity of sediment. The computation used for determining mean annual transport and yield of suspended sediment assumes a continuity of sediment movement - that is, all sediments passing the upstream sites also pass the downstream site, and the difference in the loads passing downstream and upstream sites represents all the sediments produced from the local area. This assumption is probably valid for most conditions over a long period of time. However, during a short period of time there may be a relatively large quantity of deposition within any specific reach, and the yield of a local area may only be an estimate at best. A summary of suspended sediment yields calculated from historical and projected data--base period 1943-1972--for the six sediment courses in Cache Creek Basin is tabulated as follows:

Index Point	Sediment Course	D.A. Sq. Mi.	Estimated Annual Yield in Tons: Suspended Sediment: Natural Conditions	Suspended Sediment: Preproject Conditions	Total Sediment: Natural Conditions
3	Cache Creek at Lower Lake	528.0	78,100		
5	North Fork Cache Creek near Lower Lake	197.0	247,920	77,000[1]	
6	Bear Creek near Rumsey	100.0	91,330		
7	Cache Creek above Rumsey	955.0	993,430		
8	Cache Creek near Capay	1,044.0	1,851,790		
10	Cache Creek at Yolo	1,139.0	1,048,780		1,122,195[2]

1/ Estimated yield with Indian Valley Reservoir in operation.
2/ Total estimated sediment yield including bedload.

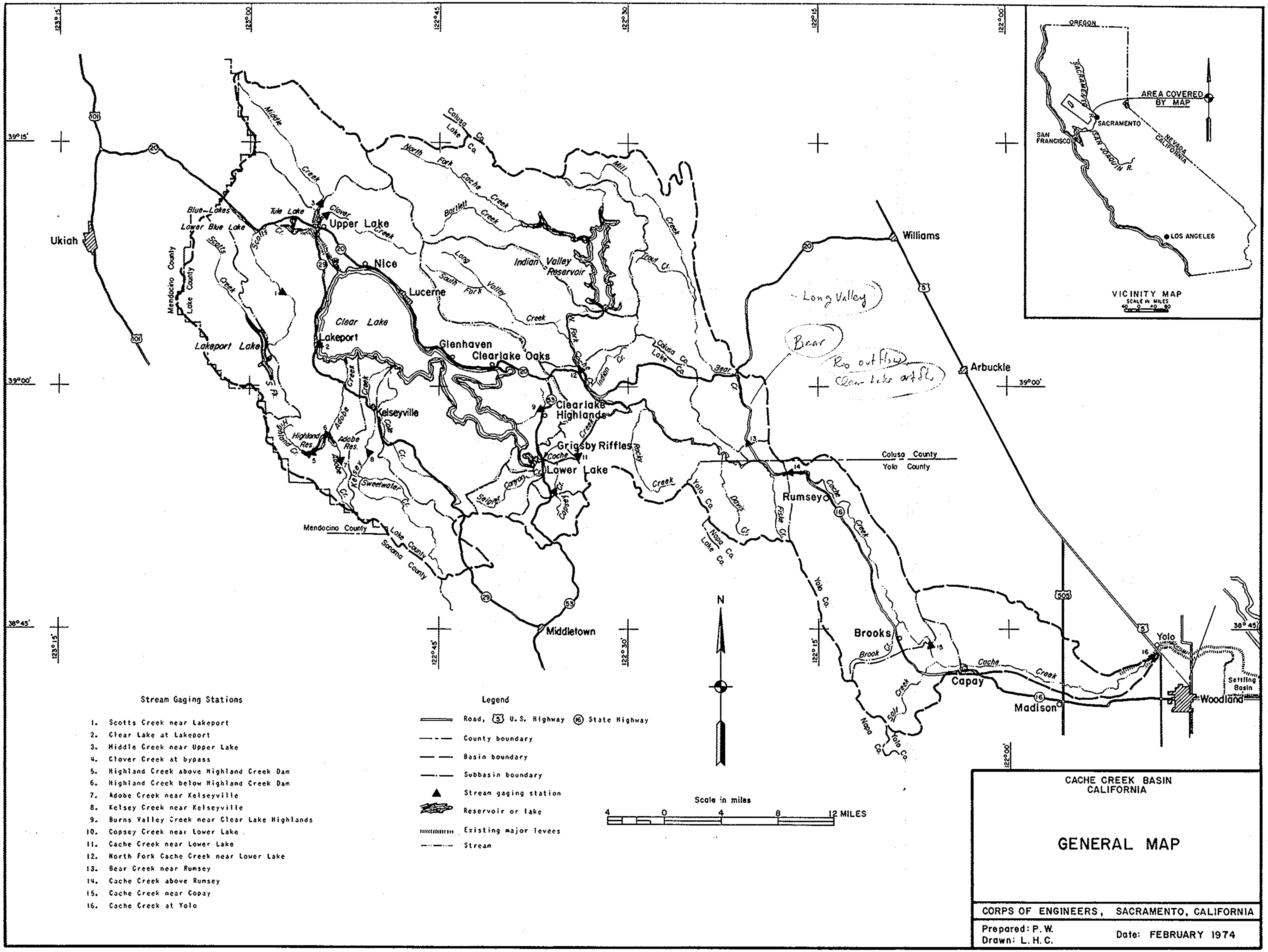
Adequate information is not yet available to accurately determine the effects of Indian Valley on sediment transport at downstream locations. Also, the bedload cannot be determined accurately for sediment courses upstream of Yolo because data are not available.

14. <u>Conclusions</u>. It is concluded that the hydrologic data presented in this report are representative of a critical combination of meteorological and hydrologic conditions reasonably characteristic of the Cache Creek watershed. Further, it is concluded that peak flow data, as presented, reflect land use projections that are adequate for the design of flood control measures.

TABLE I

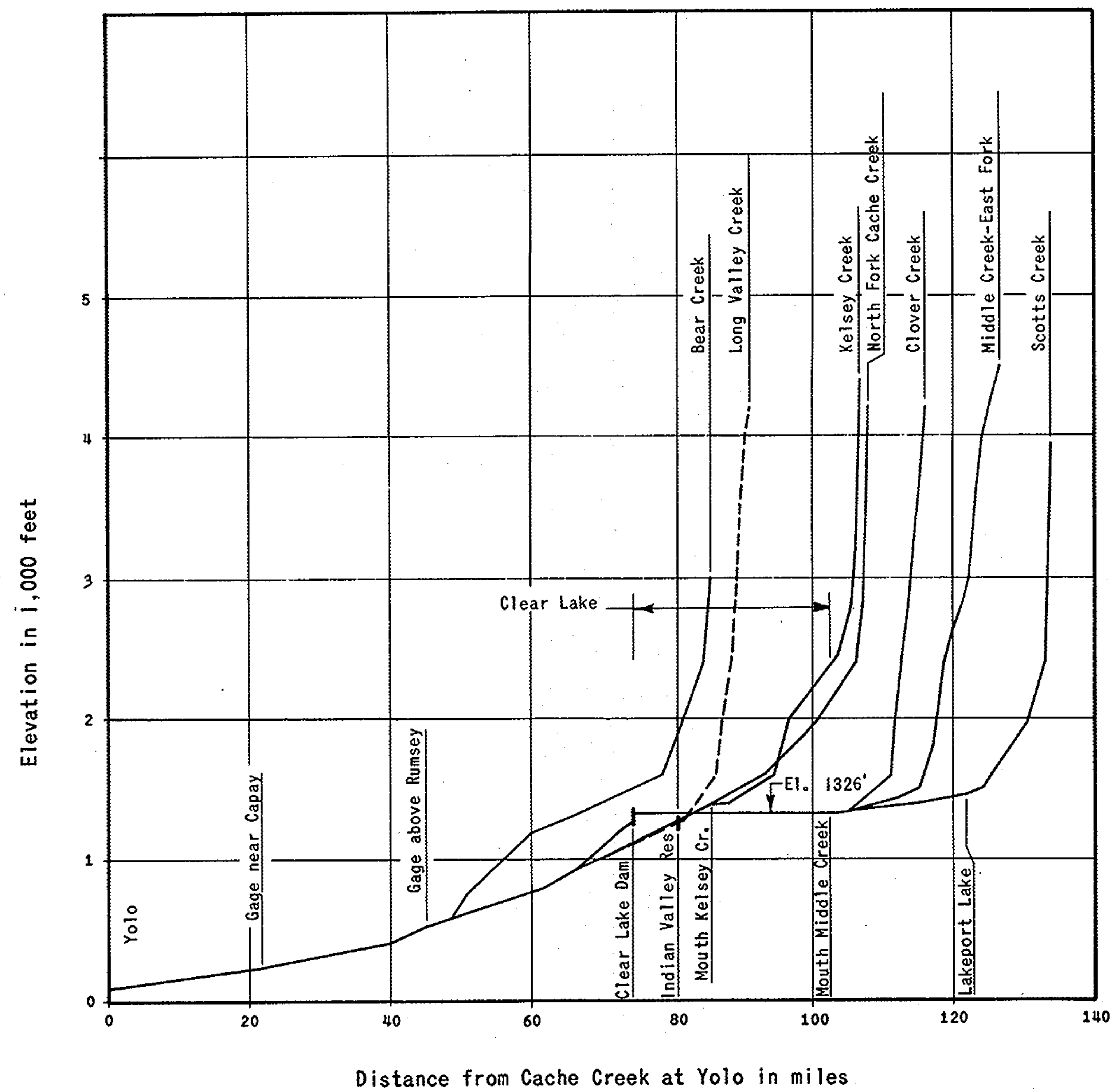
SUMMARY OF UNIT HYDROGRAPH ORDINATES

Time Period (Hours)	End of Period Flow (cfs) Index Point Reference (see chart 12)								
	2	3	4	5	6	7	8	9	10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	1,257	873	4,262	5,006	3,039	3,574	3,797	3,136	1,823
2	2,158	1,581	6,639	8,328	4,560	5,188	5,975	5,255	2,722
3	1,201	1,043	8,823	8,315	6,022	6,747	7,833	3,318	3,587
4	938	729	9,611	4,972	7,100	8,009	7,110	2,317	4,233
5	694	602	6,698	4,000	5,930	7,903	4,872	1,821	3,626
6	461	417	5,022	3,327	4,380	5,884	3,870	1,360	2,686
7	394	327	4,319	2,660	3,535	4,467	3,317	1,037	2,146
8	293	270	3,836	2,130	3,110	3,862	2,929	805	1,886
9	250	211	3,422	1,722	2,803	3,500	2,546	659	1,699
10	197	187	3,008	1,417	2,539	3,200	2,163	523	1,543
11	175	150	2,594	1,206	2,279	2,919	1,838	436	1,386
12	142	130	2,230	1,025	2,010	2,638	1,620	376	1,215
13	127	125	1,975	856	1,735	2,358	1,336	316	1,057
14	79	93	1,709	754	1,526	2,042	1,199	257	935
15	46	72	1,509	667	1,396	1,813	1,056	197	849
16	38	41	1,347	590	1,200	1,664	961	137	744
17	29	33	1,219	512	1,093	1,477	851	87	666
18	20	28	1,115	426	988	1,322	746	53	608
19	16	22	993	349	902	1,226	668	29	550
20	3	16	880	269	835	1,104	619	14	511
21		14	802	188	763	1,022	571	2	471
22		6	748	133	684	949	523		422
23			695	89	620	864	475		378
24			643	56	575	786	427		349
25			590	32	541	722	375		329
26			539	14	507	675	326		310
27			487	2	472	638	277		290
28			436		439	597	230		271
29			384		406	561	182		251
30			332		373	527	141		231
31			280		340	492	108		212
32			228		307	457	80		192
33			180		274	421	60		173
34			145		241	383	42		152
35			113		208	344	28		132
36			88		175	309	18		112
37			68		142	273	8		93
38			46		115	239			76
39			34		95	203			62
40			22		74	169			51
41			12		60	136			40
42			2		47	114			33
43					34	93			25
44					25	77			17
45					18	62			13
46					12	48			9
47					5	34			5
48						25			1
49						19			
50						10			
51						5			
52									
53									
54									
55									
Sum:	8,518	6,970	78,085	49,045	64,533	82,151	59,177	22,135	39,172
Peak (cfs)	2,400	1,800	10,200	9,400	7,300	9,300	9,200	5,400	6,150
DA (sq. mi.)	13.20	10.80	121.0	76.0	100.0	127.3	91.7	34.3	60.7



Stream Gaging Stations
1. Scotts Creek near Lakeport
2. Clear Lake at Lakeport
3. Middle Creek near Upper Lake
4. Clover Creek at bypass
5. Highland Creek above Highland Creek Dam
6. Highland Creek below Highland Creek Dam
7. Adobe Creek near Kelseyville
8. Kelsey Creek near Kelseyville
9. Burns Valley Creek near Clear Lake Highlands
10. Copsey Creek near Lower Lake
11. Cache Creek near Lower Lake
12. North Fork Cache Creek near Lower Lake
13. Bear Creek near Rumsey
14. Cache Creek above Rumsey
15. Cache Creek near Capay
16. Cache Creek at Yolo
Legend
Road, U.S. Highway, State Highway
County boundary
Basin boundary
Subbasin boundary
Stream gaging station
Reservoir or lake
Existing major levees
Stream
Scale in miles
4 0 4 8 12 MILES
N
VICINITY MAP
OREGON
NEVADA
CALIFORNIA
SACRAMENTO
SAN FRANCISCO
LOS ANGELES
AREA COVERED BY MAP
Ukiah
Upper Lake
Nice
Lucerne
Clear Lake
Lakeport
Glenhaven
Clearlake Oaks
Clearlake Highlands
Kelseyville
Grigsby Riffles
Lower Lake
Middletown
Williams
Arbuckle
Rumsey
Brooks
Capay
Madison
Yolo
Woodland
Indian Valley Reservoir
Blue Lakes
Lower Blue Lake
Tule Lake
Lakeport Lake
Highland Res.
Adobe Res.
Settling Basin
Colusa County
Yolo County
Mendocino County
Lake County
Sonoma County
Long Valley
Bear
Res outflow
Clear Lake outflow
CACHE CREEK BASIN
CALIFORNIA
GENERAL MAP
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

CHART I



CACHE CREEK BASIN
CALIFORNIA

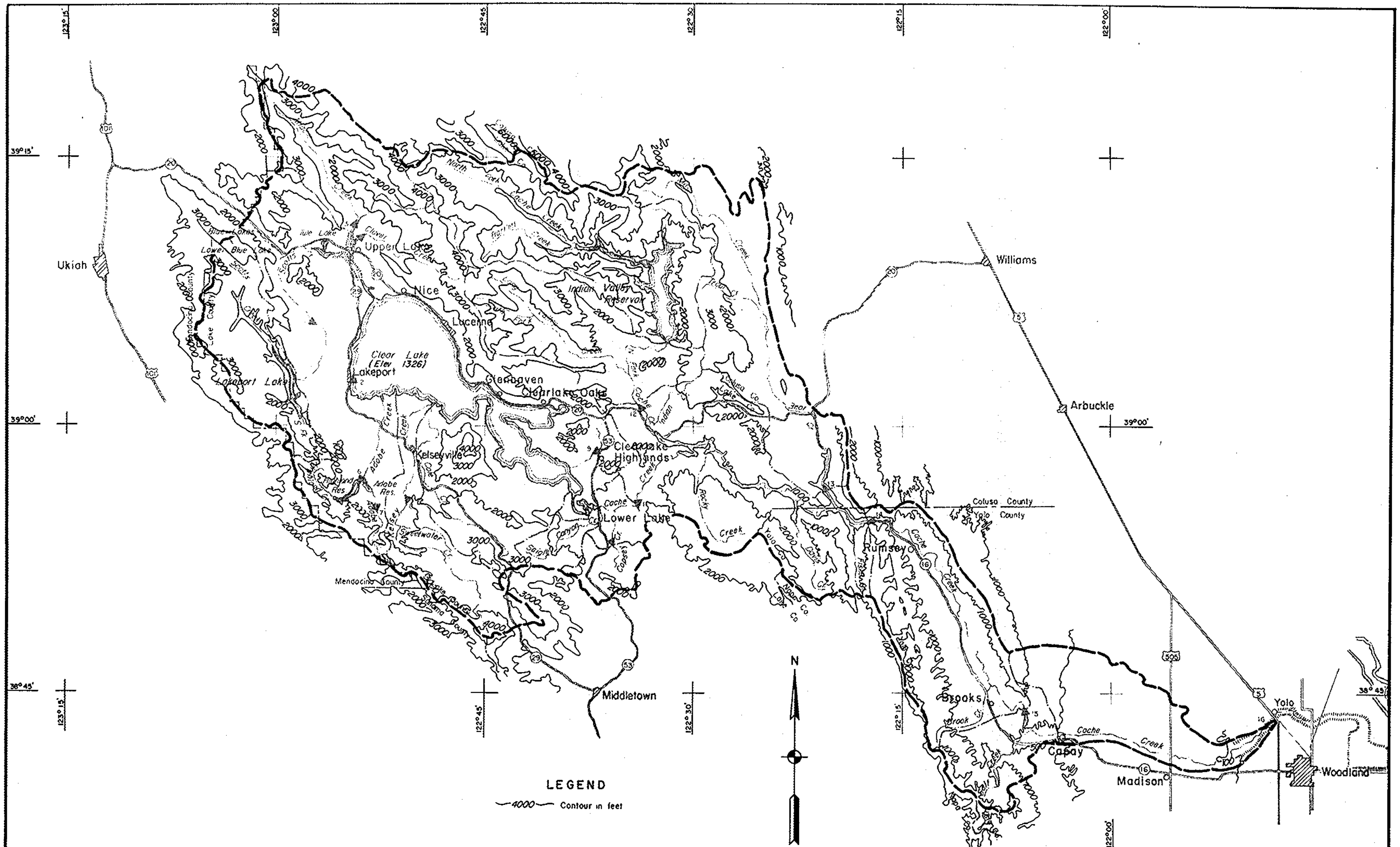
STREAM PROFILES

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: L.H.C.

Date: FEBRUARY 1974

CHART 2



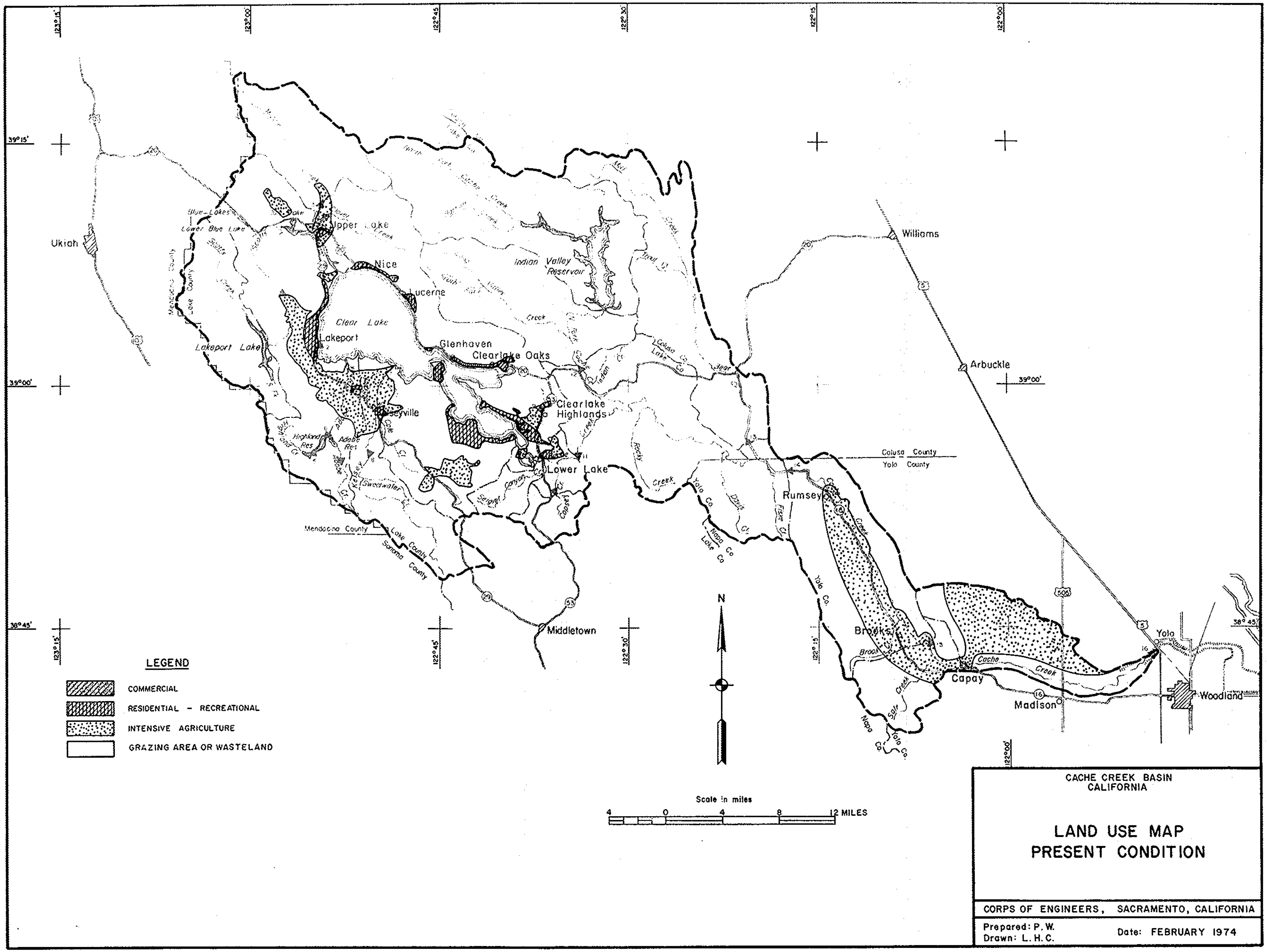
CACHE CREEK BASIN
CALIFORNIA

TOPOGRAPHY MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

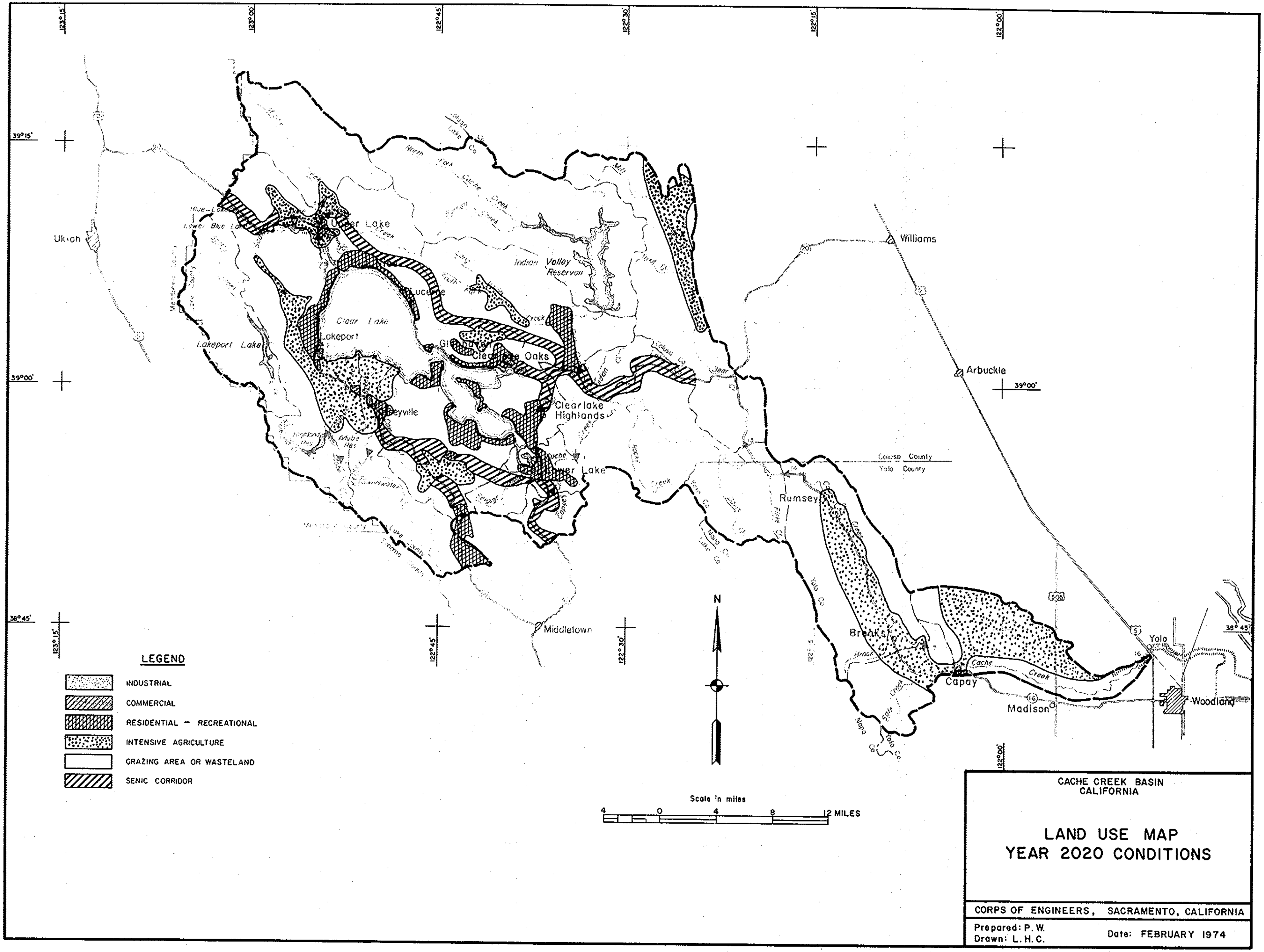
Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

CHART 3



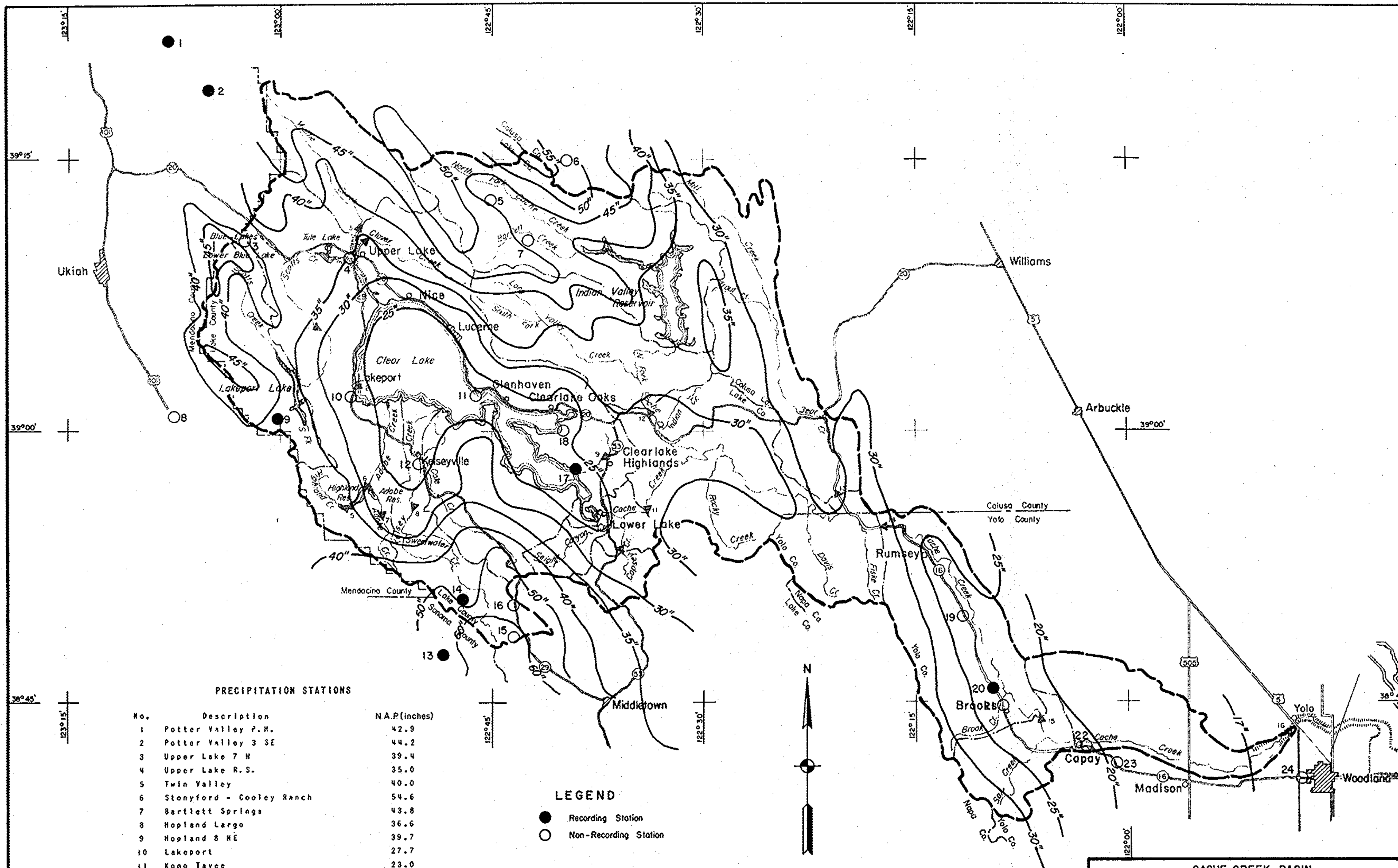
Ukiah
Williams
Arbuckle
Upper Lake
Nice
Lucerne
Indian Valley Reservoir
Clear Lake
Lakeport
Lakeport Lake
Glenhaven
Clearlake Oaks
Clearlake Highlands
Lower Lake
Middletown
Rumsey
Brooks
Capay
Madison
Yolo
Woodland
Colusa County
Yolo County
Mendocino County
Lake County
Sonoma County
LEGEND
COMMERCIAL
RESIDENTIAL - RECREATIONAL
INTENSIVE AGRICULTURE
GRAZING AREA OR WASTELAND
Scale in miles
4 0 4 8 12 MILES
CACHE CREEK BASIN
CALIFORNIA
LAND USE MAP
PRESENT CONDITION
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

CHART 4



CACHE CREEK BASIN
CALIFORNIA
LAND USE MAP
YEAR 2020 CONDITIONS
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA
Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974
LEGEND
INDUSTRIAL
COMMERCIAL
RESIDENTIAL – RECREATIONAL
INTENSIVE AGRICULTURE
GRAZING AREA OR WASTELAND
SENIC CORRIDOR
Scale in miles
4
0
4
8
12 MILES
N
123°15'
123°00'
122°45'
122°30'
122°15'
122°00'
39°15'
39°00'
38°45'
Ukiah
Upper Lake
Lucerne
Clear Lake
Lakeport
Lakeport Lake
Clearlake Oaks
Clearlake Highlands
Indian Valley Reservoir
Williams
Arbuckle
Colusa County
Yolo County
Rumsey
Brooks
Capay
Madison
Yolo
Woodland
Middletown
Cache Creek

CHART 5



PRECIPITATION STATIONS

No.	Description	N.A.P.(inches)
1	Potter Valley P.H.	42.9
2	Potter Valley 3 SE	44.2
3	Upper Lake 7 N	39.4
4	Upper Lake R.S.	35.0
5	Twin Valley	40.0
6	Stonyford - Cooley Ranch	54.6
7	Bartlett Springs	43.8
8	Hopland Largo	36.6
9	Hopland 8 NE	39.7
10	Lakeport	27.7
11	Kono Tayee	23.0
12	Kelseyville	23.5
13	The Geysers	54.0
14	Hahnke	47.7
15	Cobb	60.5
16	Hobergs	54.0
17	Clearlake Highlands	23.6
18	Sulphur Bnks.	24.6
19	Guinda	20.9
20	Brook Farnham Ranch	20.0
21	Brooks	20.5
22	Capay	22.1
23	Esparto	17.5
24	Woodland IWNW	16.9

CACHE CREEK BASIN
CALIFORNIA

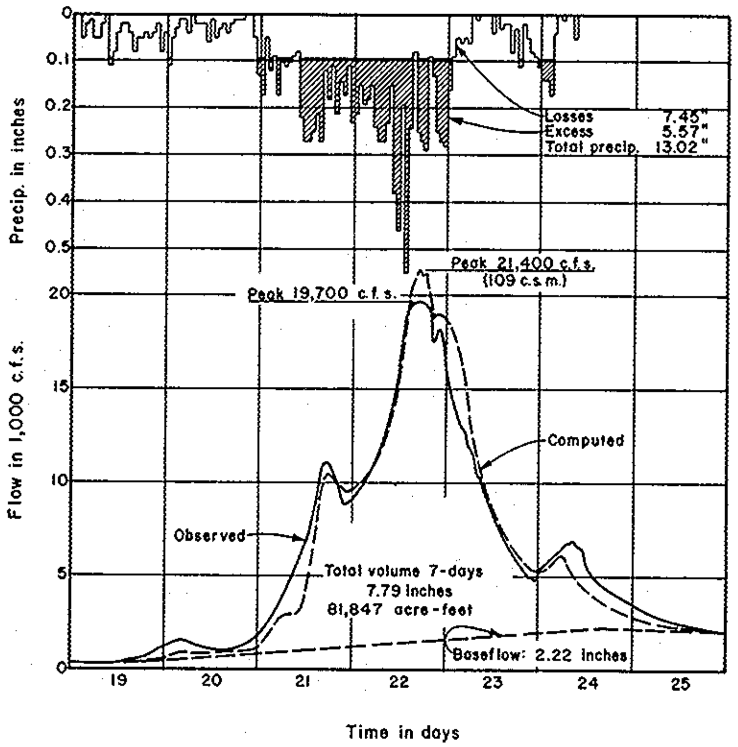
NORMAL ANNUAL PRECIPITATION MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

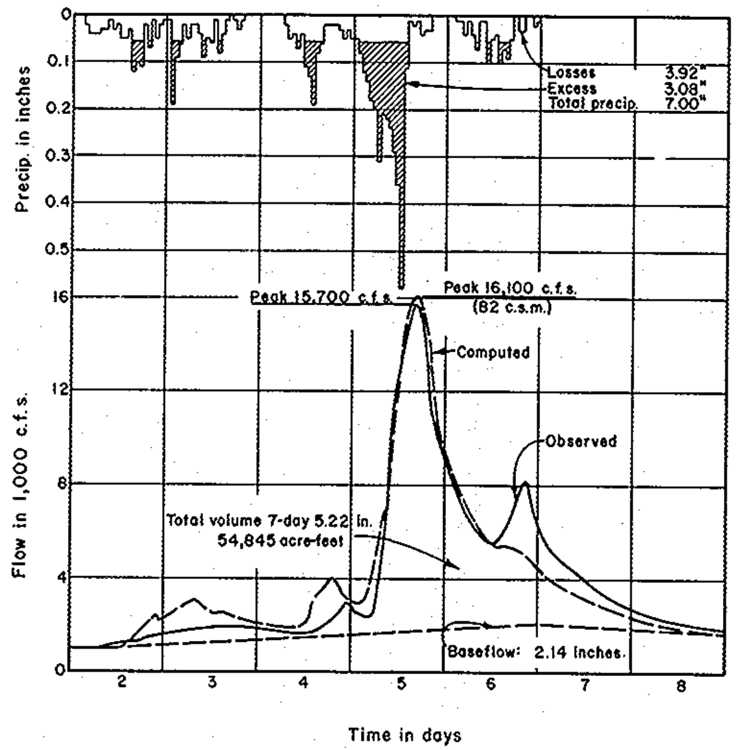
Prepared: L. L. W.
Drawn: L. H. C.

Date: FEBRUARY 1974

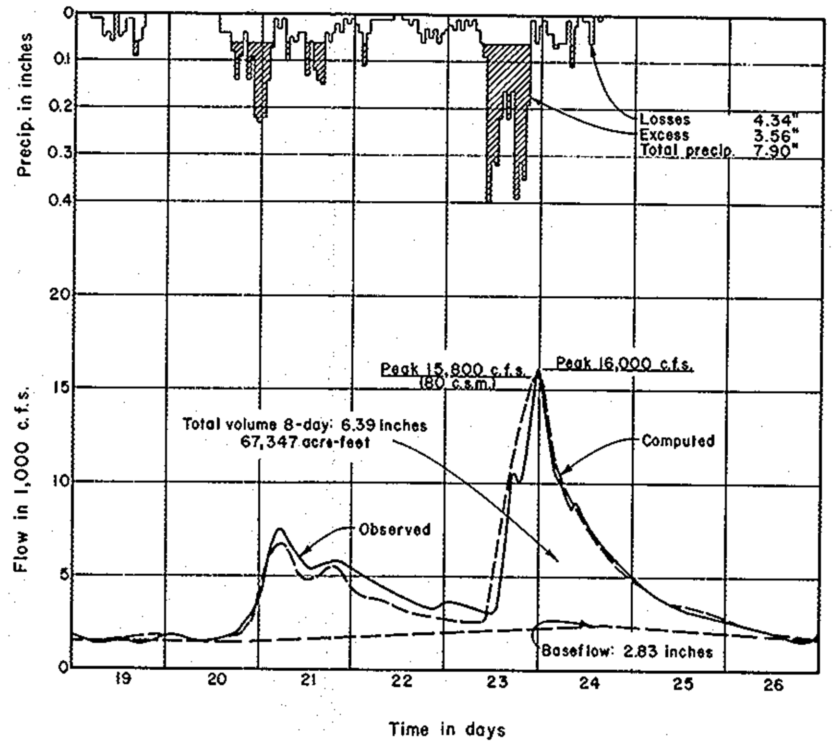
CHART 6



December 1964



January 1965



January 1970

Drainage Area: 197.0 sq. mi.

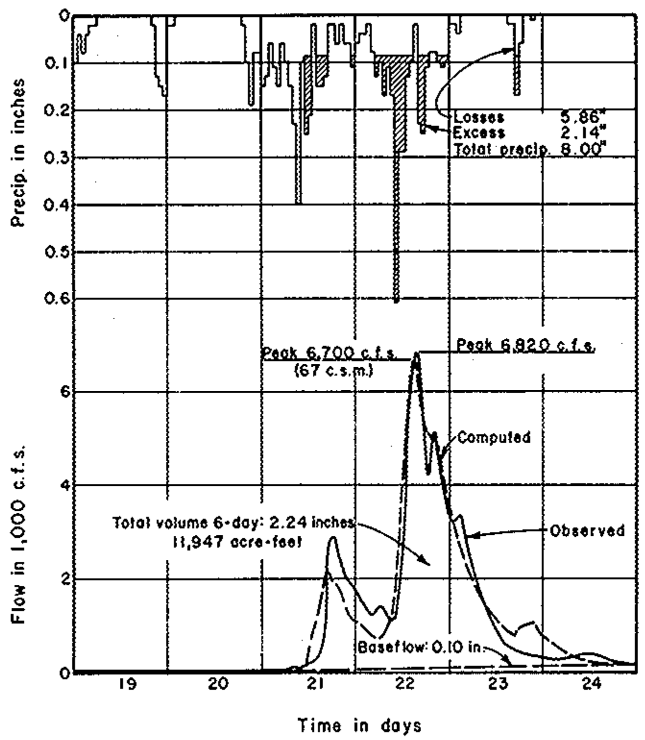
CACHE CREEK BASIN
CALIFORNIA

FLOOD HYDROGRAPHS
NORTH FORK CACHE CREEK NEAR LOWER LAKE INDEX POINT-5

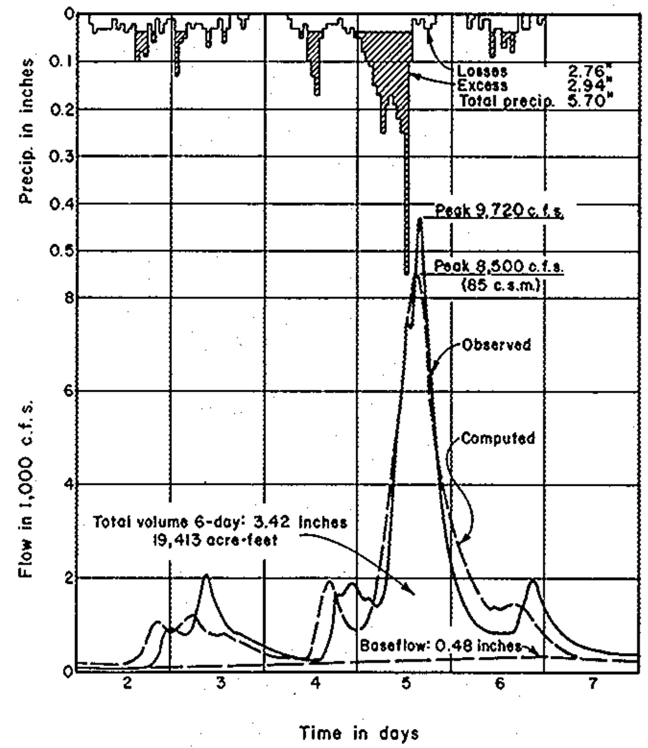
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

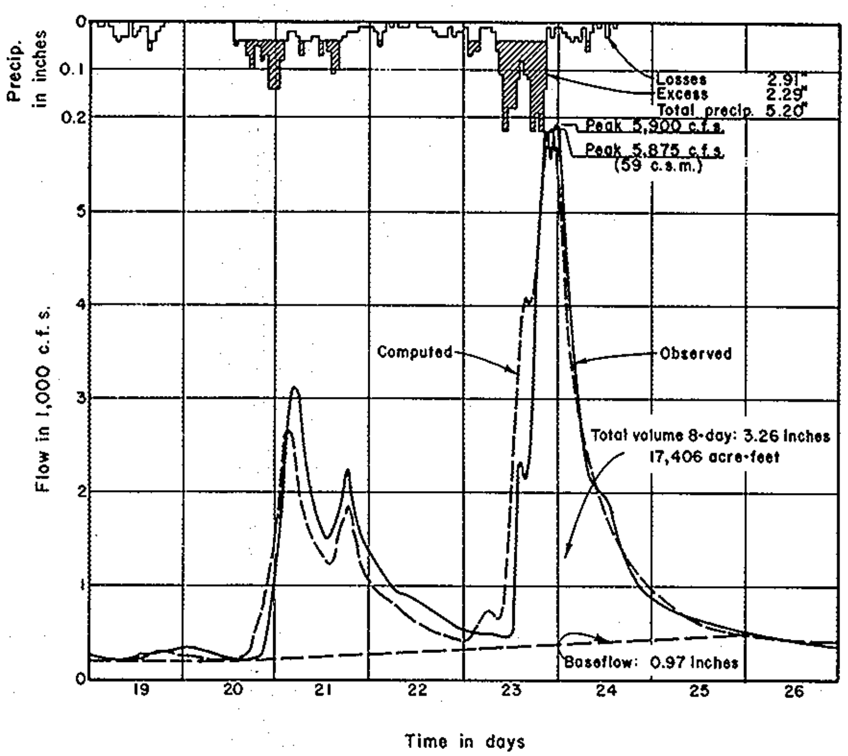
CHART 7



December 1964



January 1965



January 1970

Drainage area: 100 sq. mi.

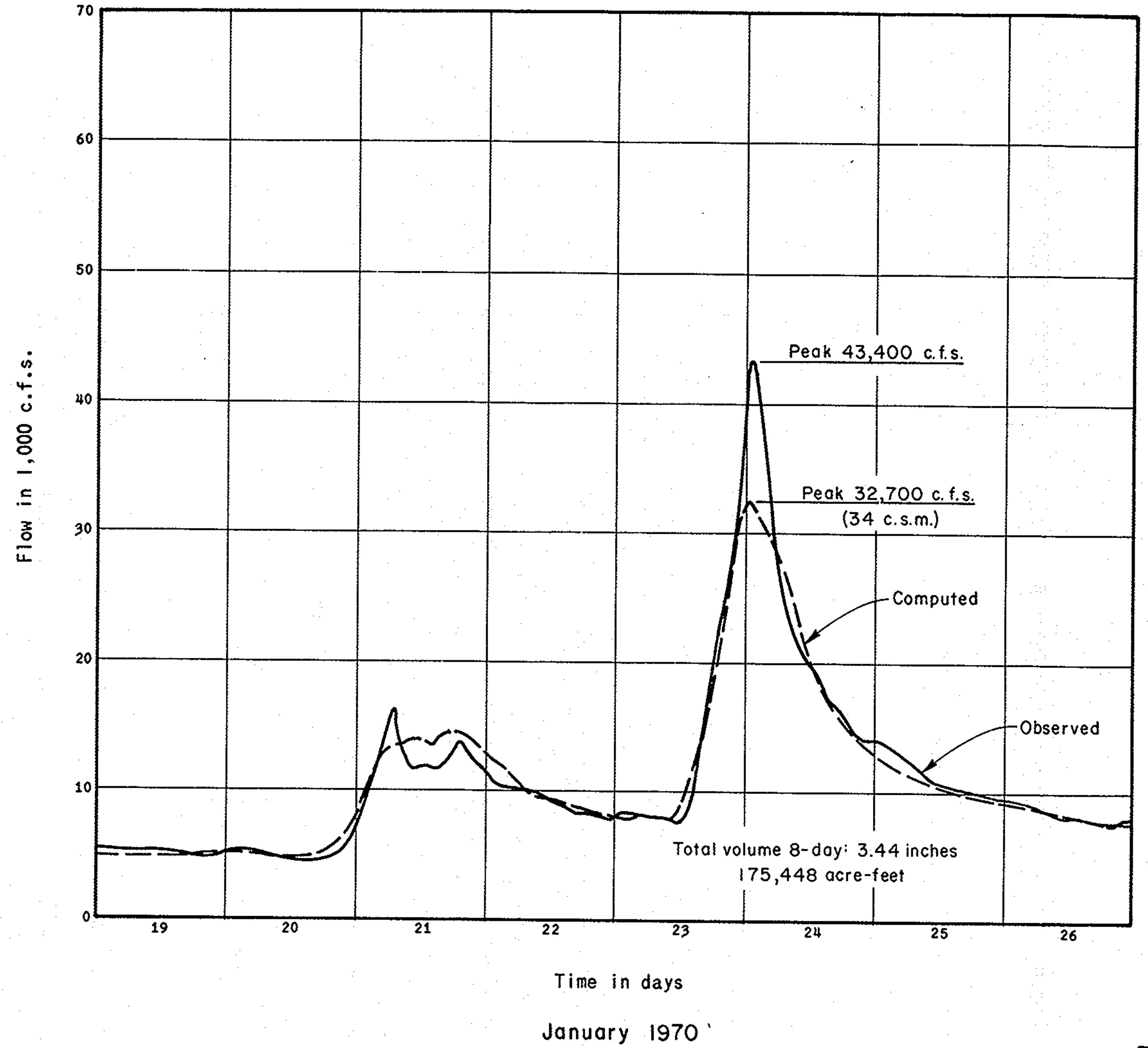
CACHE CREEK BASIN
CALIFORNIA

FLOOD HYDROGRAPHS
BEAR CREEK NEAR RUMSEY
INDEX POINT 6

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P. W.
Drawn: L.H.C.
Date: FEBRUARY 1974

CHART 8



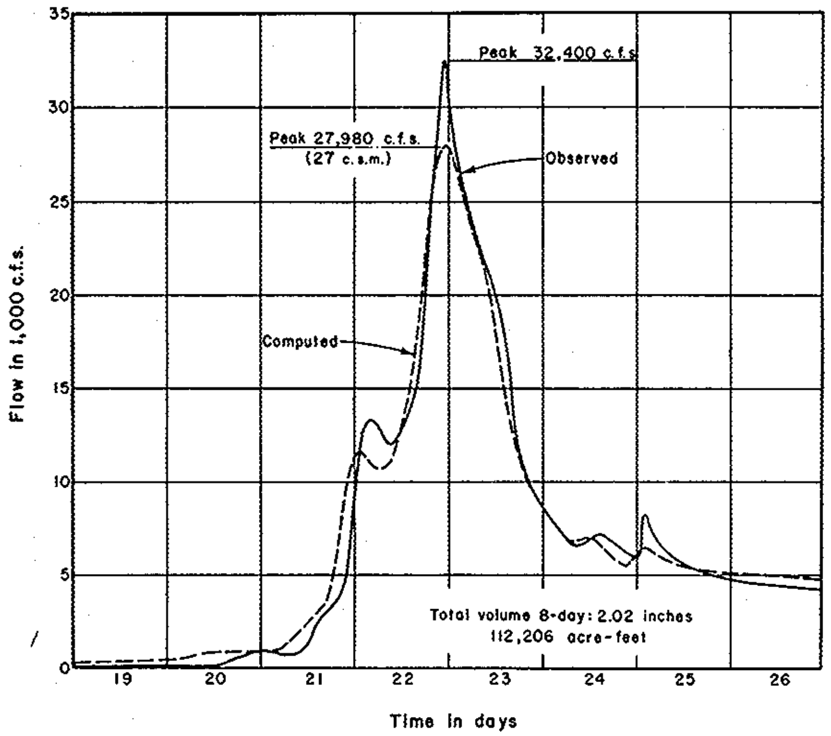
CACHE CREEK BASIN
CALIFORNIA

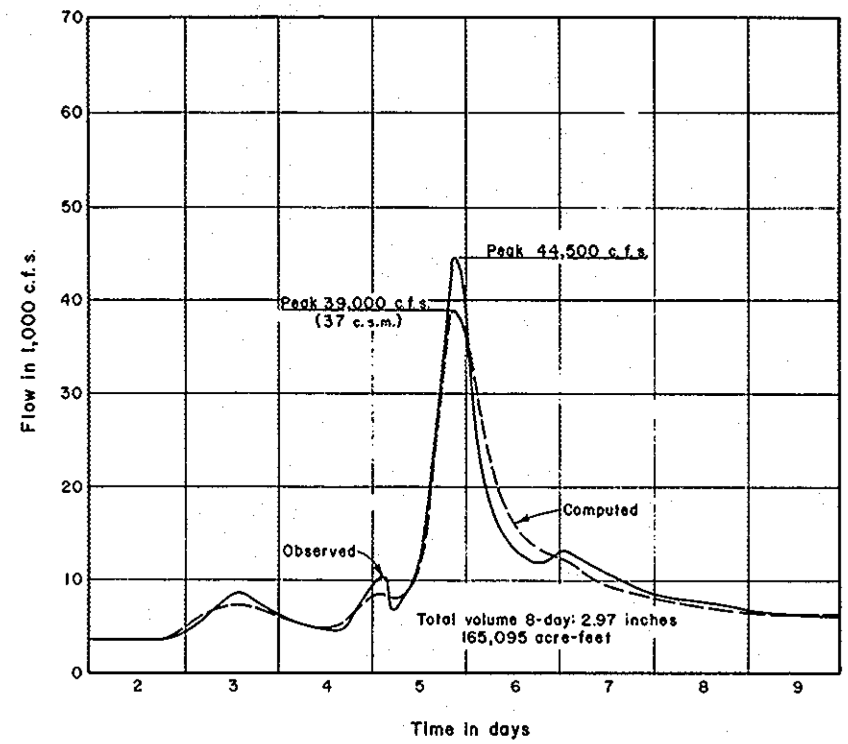
FLOOD HYDROGRAPH
CACHE CREEK ABOVE RUMSEY
INDEX POINT - 7

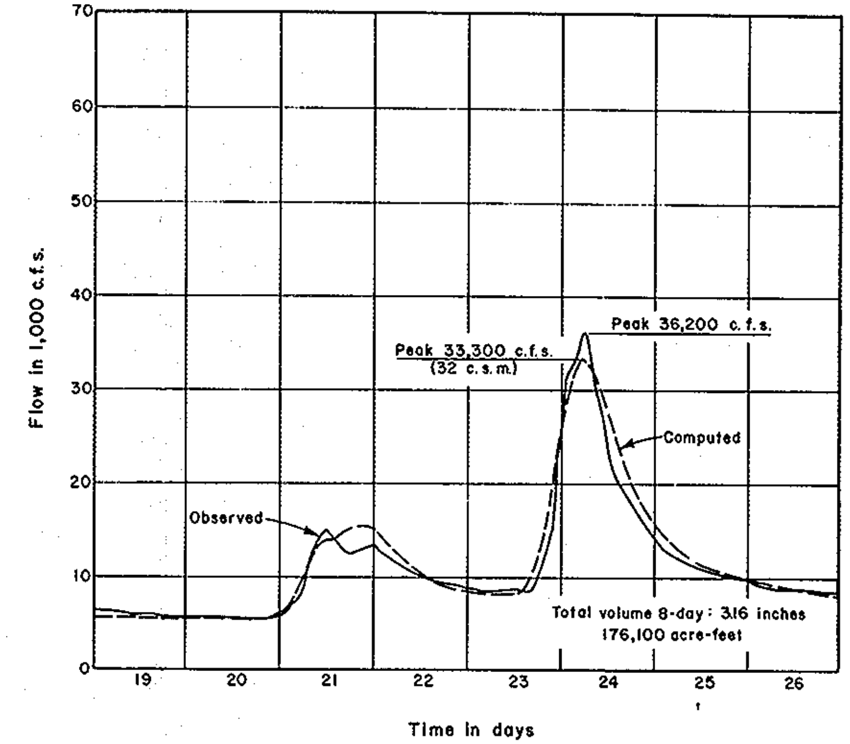
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: L.H.C.
Date: FEBRUARY 1974

CHART 9







Drainage Area: 1044 sq. mi.

CACHE CREEK BASIN
CALIFORNIA

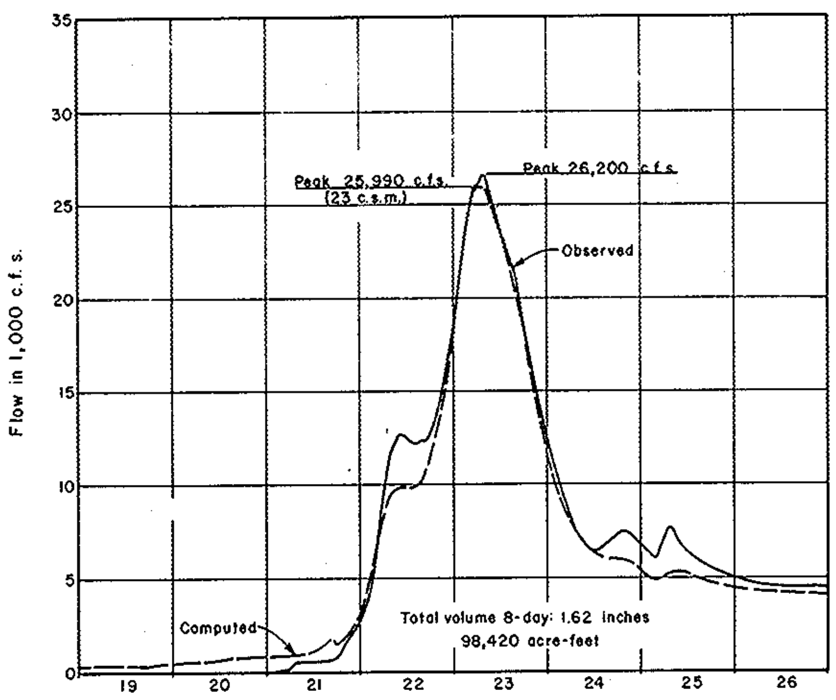
FLOOD HYDROGRAPHS
CACHE CREEK NEAR CAPAY
INDEX POINT-8

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

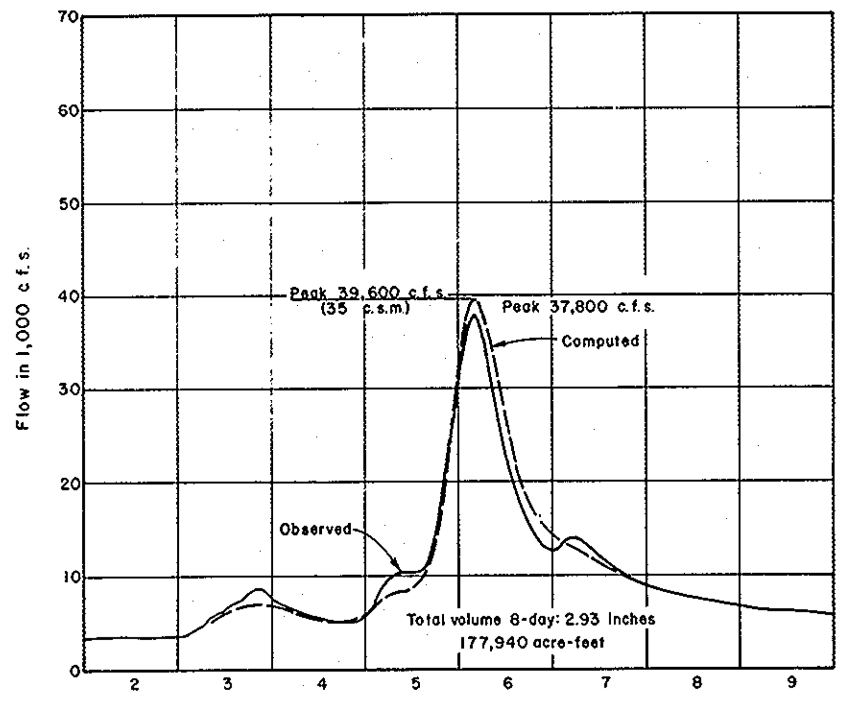
Prepared: P. W.
Drawn: L. H. C.

Date: FEBRUARY 1974

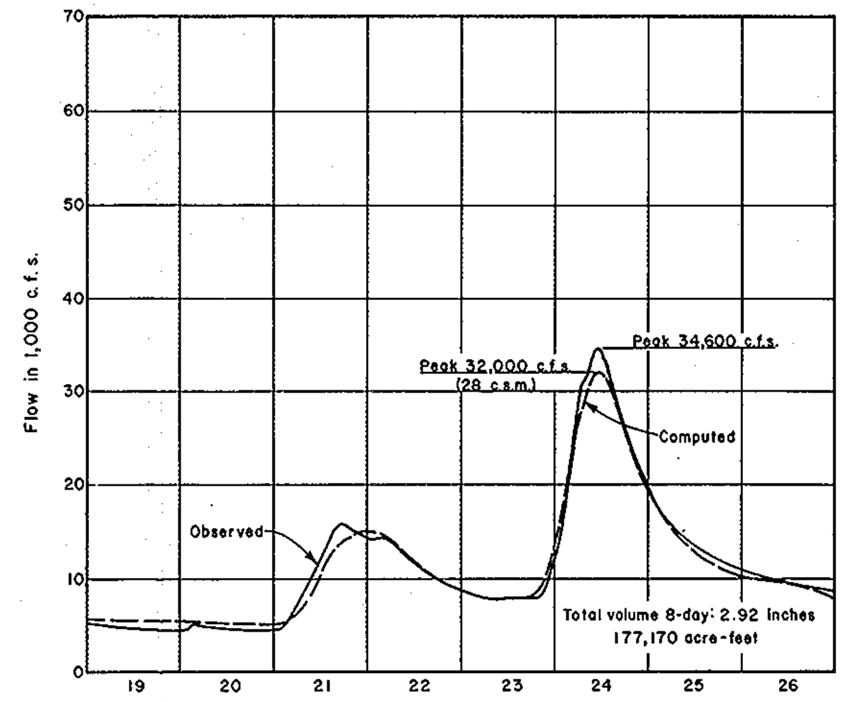
CHART 10



December 1964



January 1965



January 1970

Drainage Area: 1139 sq. mi.

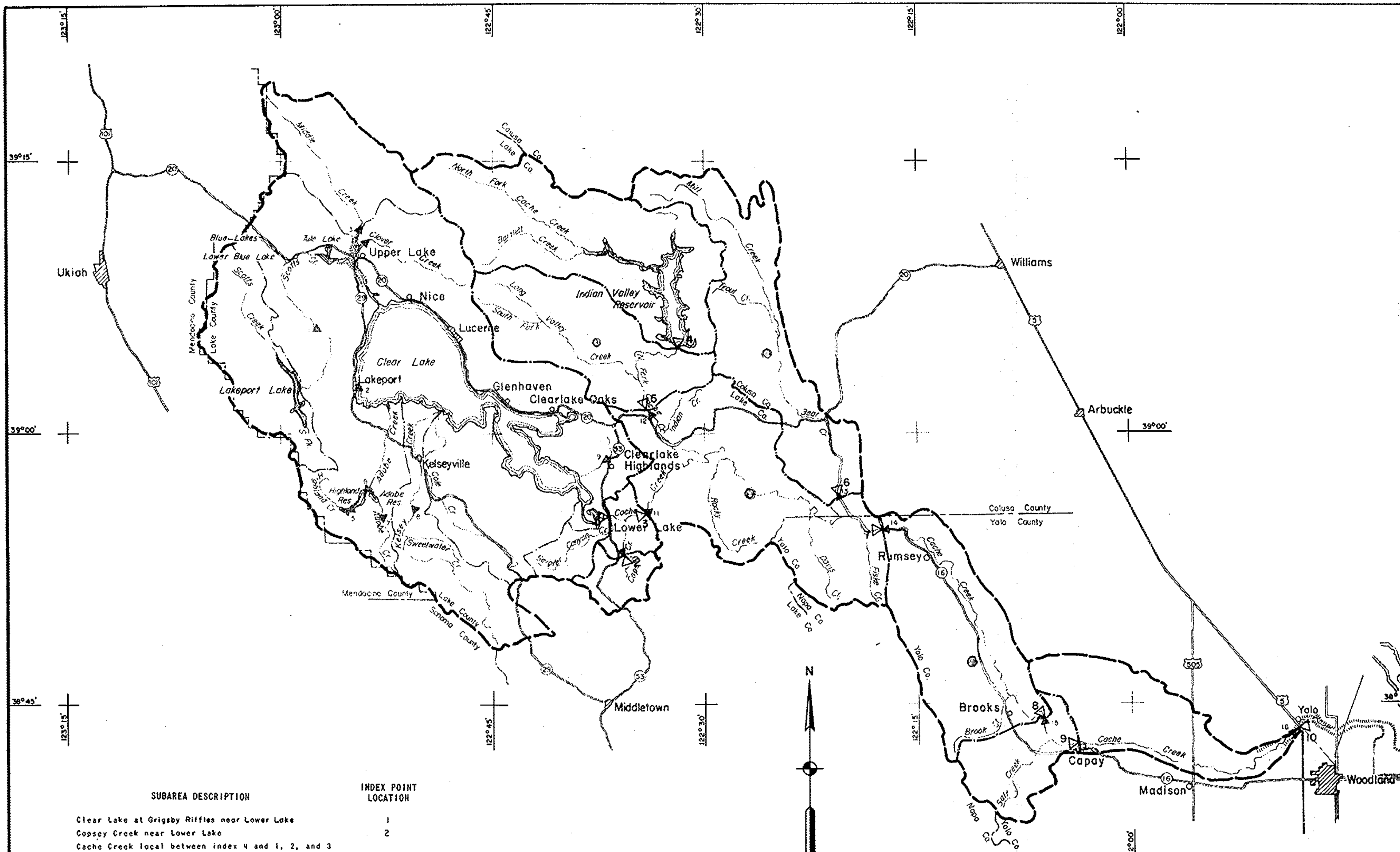
CACHE CREEK BASIN
CALIFORNIA

FLOOD HYDROGRAPHS
CACHE CREEK AT YOLO
INDEX POINT-10

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

CHART 11



SUBAREA DESCRIPTION	INDEX POINT LOCATION
Clear Lake at Grigsby Riffles near Lower Lake	1
Copsey Creek near Lower Lake	2
Cache Creek local between index 4 and 1, 2, and 3	
Cache Creek near Lower Lake	3
North Fork Cache Creek at Indian Valley Reservoir	4
North Fork Cache Creek local between 4 and 3	
North Fork Cache Creek near Lower Lake	5
Bear Creek near Rumsey	6
Cache Creek local between index 6 and 5, 4, and 3	
Cache Creek above Rumsey	7
Cache Creek local between index 7 and 6	
Cache Creek near Capay	8
Cache Creek local between index 8 and 7	9
Cache Creek local between index 9 and 8	
Cache Creek at Yolo	10

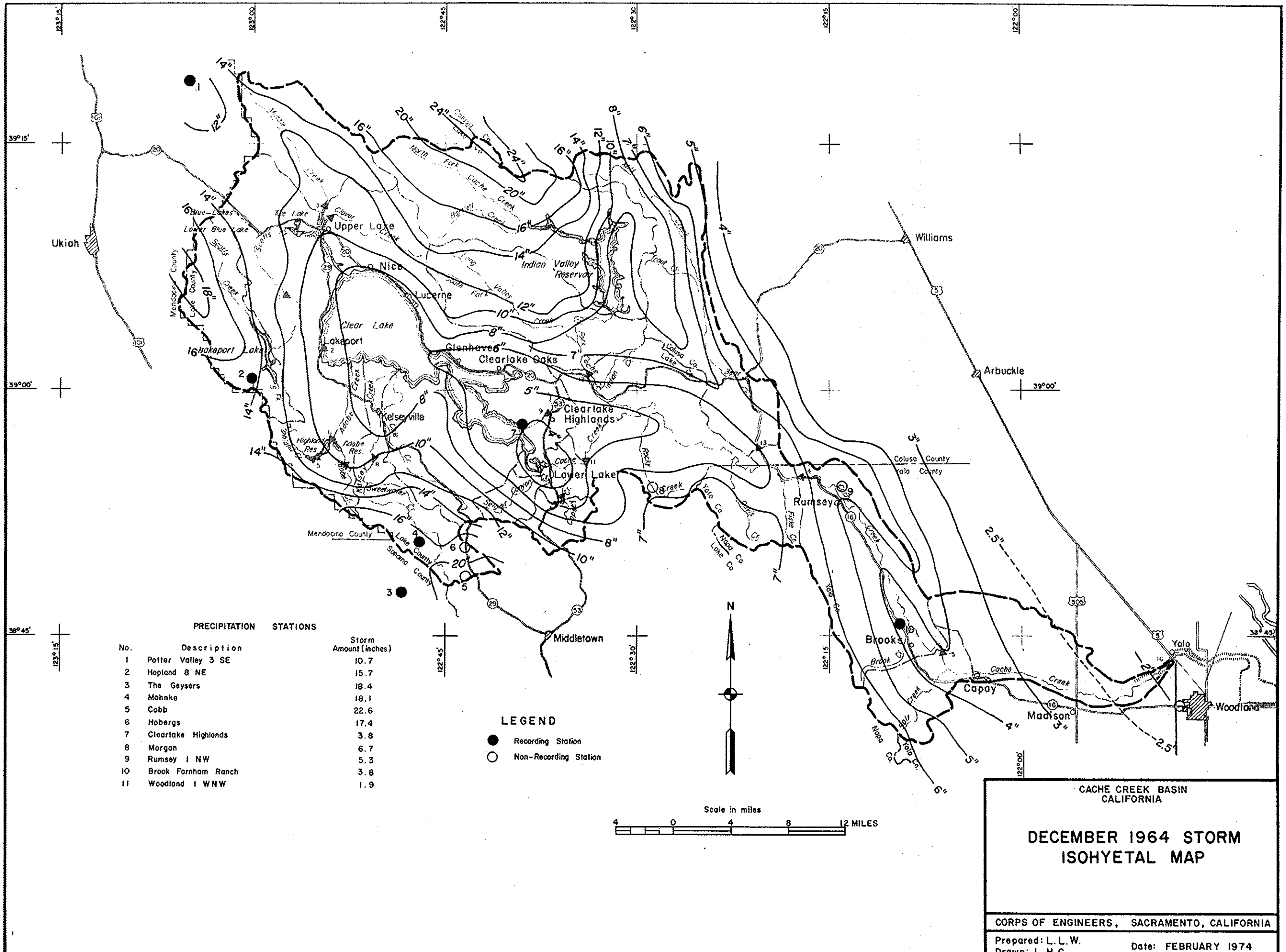
CACHE CREEK BASIN
CALIFORNIA

SUBAREA MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P. W.
Drawn: L. H. C.
Date: FEBRUARY 1974

CHART 12



PRECIPITATION STATIONS

No.	Description	Storm Amount (inches)
1	Potter Valley 3 SE	10.7
2	Hopland 8 NE	15.7
3	The Geysers	18.4
4	Mahnke	18.1
5	Cobb	22.6
6	Hobergs	17.4
7	Clearlake Highlands	3.8
8	Morgan	6.7
9	Rumsey 1 NW	5.3
10	Brook Farnham Ranch	3.8
11	Woodland 1 WNW	1.9

LEGEND

● Recording Station

○ Non-Recording Station

Scale in miles

4 0 4 8 12 MILES

CACHE CREEK BASIN
CALIFORNIA

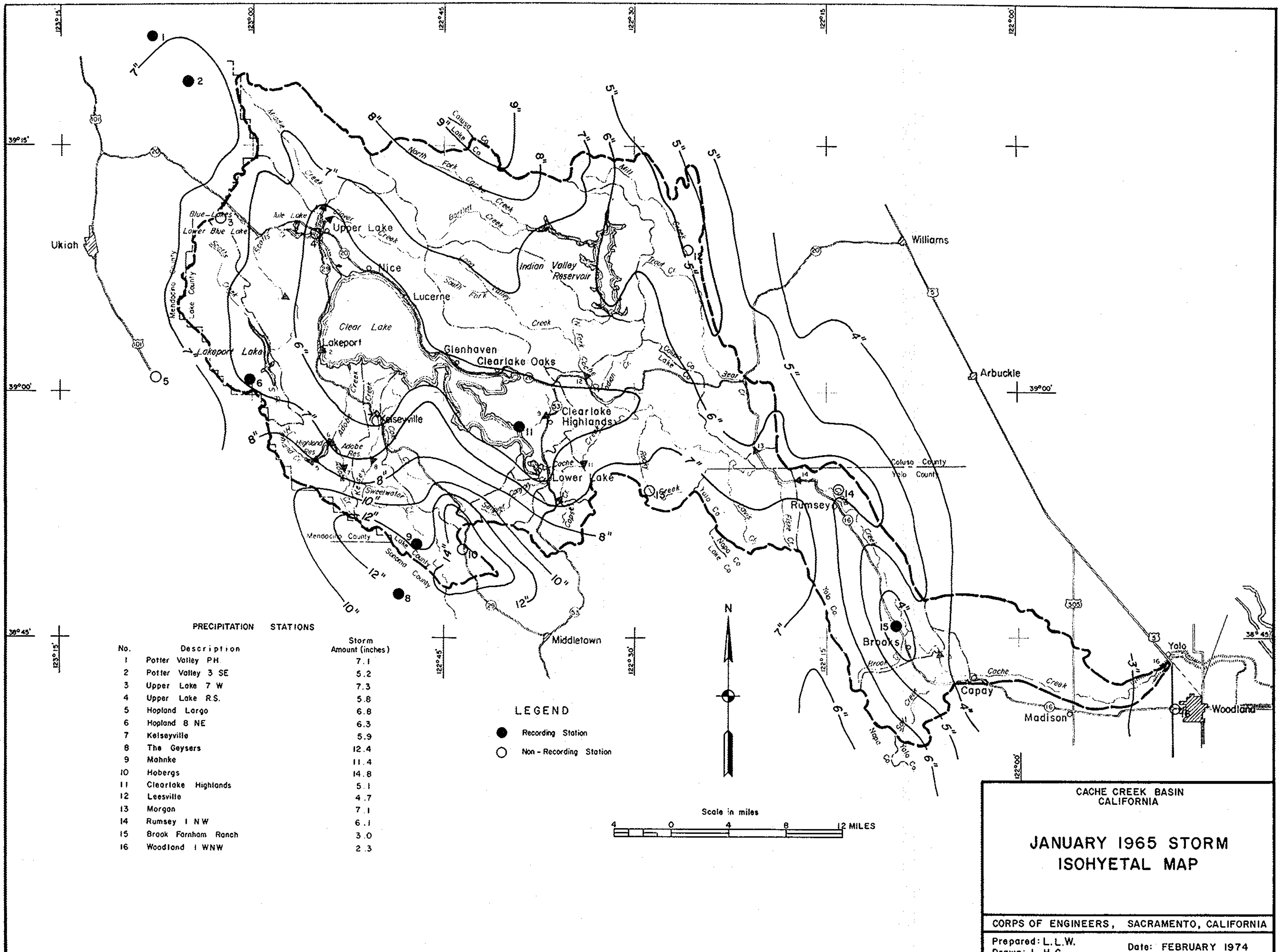
DECEMBER 1964 STORM ISOHYETAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L. L. W.
Drawn: L. H. C.

Date: FEBRUARY 1974

CHART 13



PRECIPITATION STATIONS

No.	Description	Storm Amount (inches)
1	Potter Valley P.H.	7.1
2	Potter Valley 3 SE	5.2
3	Upper Lake 7 W	7.3
4	Upper Lake R.S.	5.8
5	Hopland Largo	6.8
6	Hopland 8 NE	6.3
7	Kelseyville	5.9
8	The Geysers	12.4
9	Mahnke	11.4
10	Hobergs	14.8
11	Clearlake Highlands	5.1
12	Leesville	4.7
13	Morgan	7.1
14	Rumsey 1 NW	6.1
15	Brook Farnham Ranch	3.0
16	Woodland 1 WNW	2.3

CACHE CREEK BASIN
CALIFORNIA

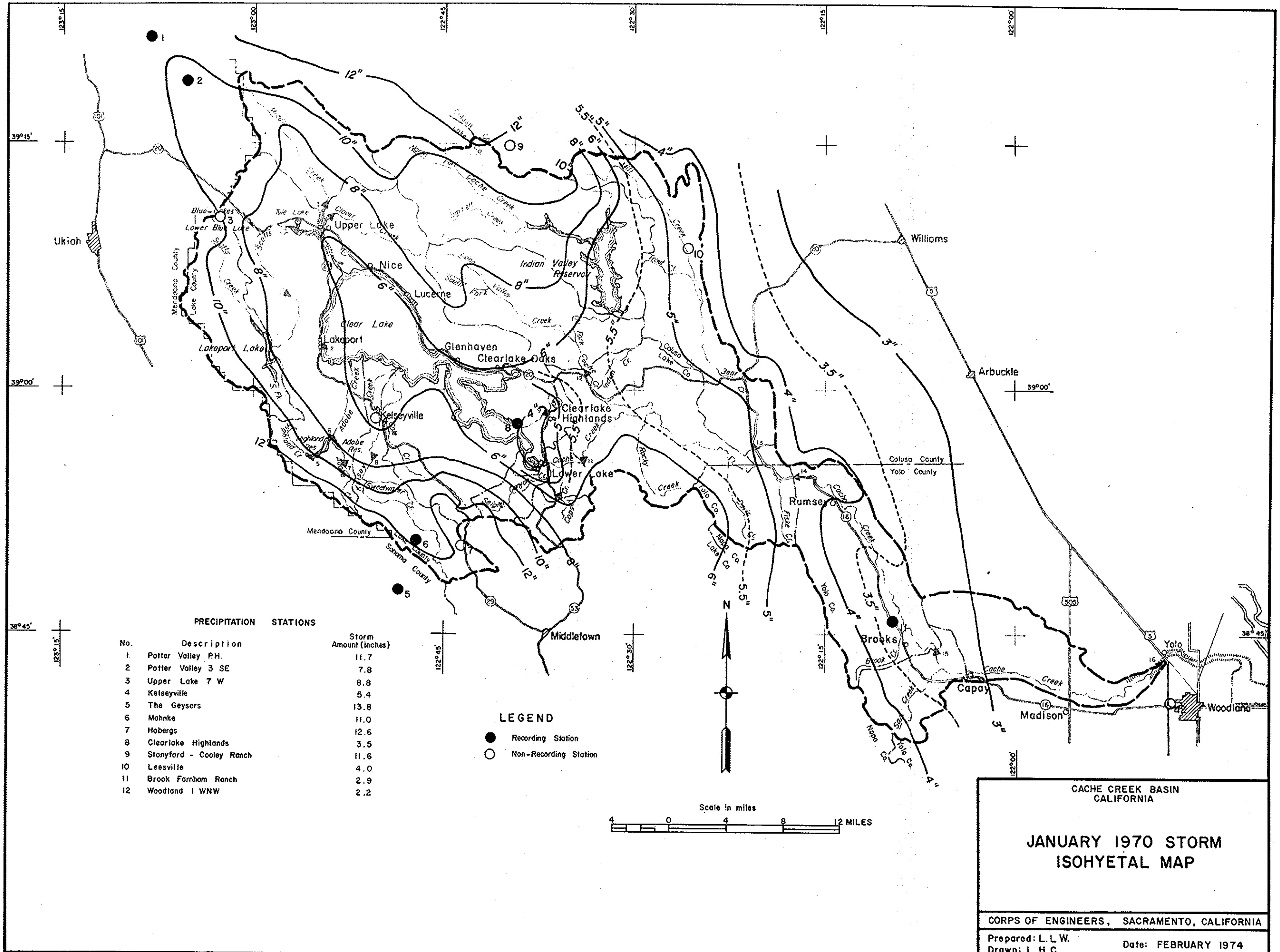
JANUARY 1965 STORM ISOHYETAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L.L.W.
Drawn: L.H.C.

Date: FEBRUARY 1974

CHART 14



PRECIPITATION STATIONS

No.	Description	Storm Amount (inches)
1	Potter Valley P.H.	11.7
2	Potter Valley 3 SE	7.8
3	Upper Lake 7 W	8.8
4	Kelseyville	5.4
5	The Geysers	13.8
6	Mohnke	11.0
7	Hobergs	12.6
8	Clearlake Highlands	3.5
9	Stonyford - Cooley Ranch	11.6
10	Leesville	4.0
11	Brook Farnham Ranch	2.9
12	Woodland 1 WNW	2.2

LEGEND

● Recording Station

○ Non-Recording Station

CACHE CREEK BASIN
CALIFORNIA

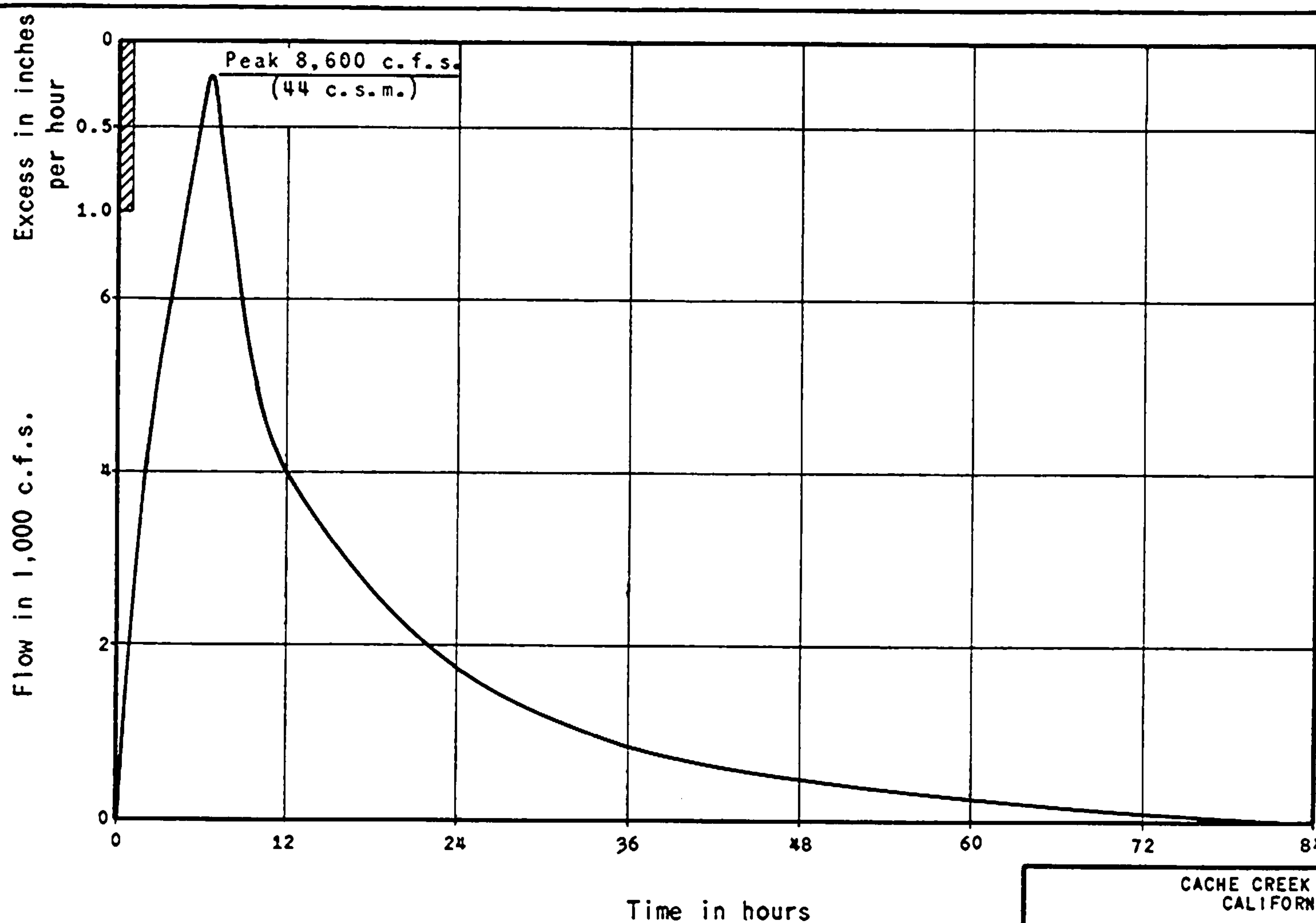
JANUARY 1970 STORM ISOHYETAL MAP

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: L. L. W.
Drawn: L. H. C.

Date: FEBRUARY 1974

CHART 15



DRAINAGE AREA	197.0 sq. mi.
$LL_{ca}/S^{.5}$	73.33
$\bar{n}$	0.090
Lag	11.05 hours
Peak	8,600 c.f.s.
Volume	127,131 1-hr. c.f.s.

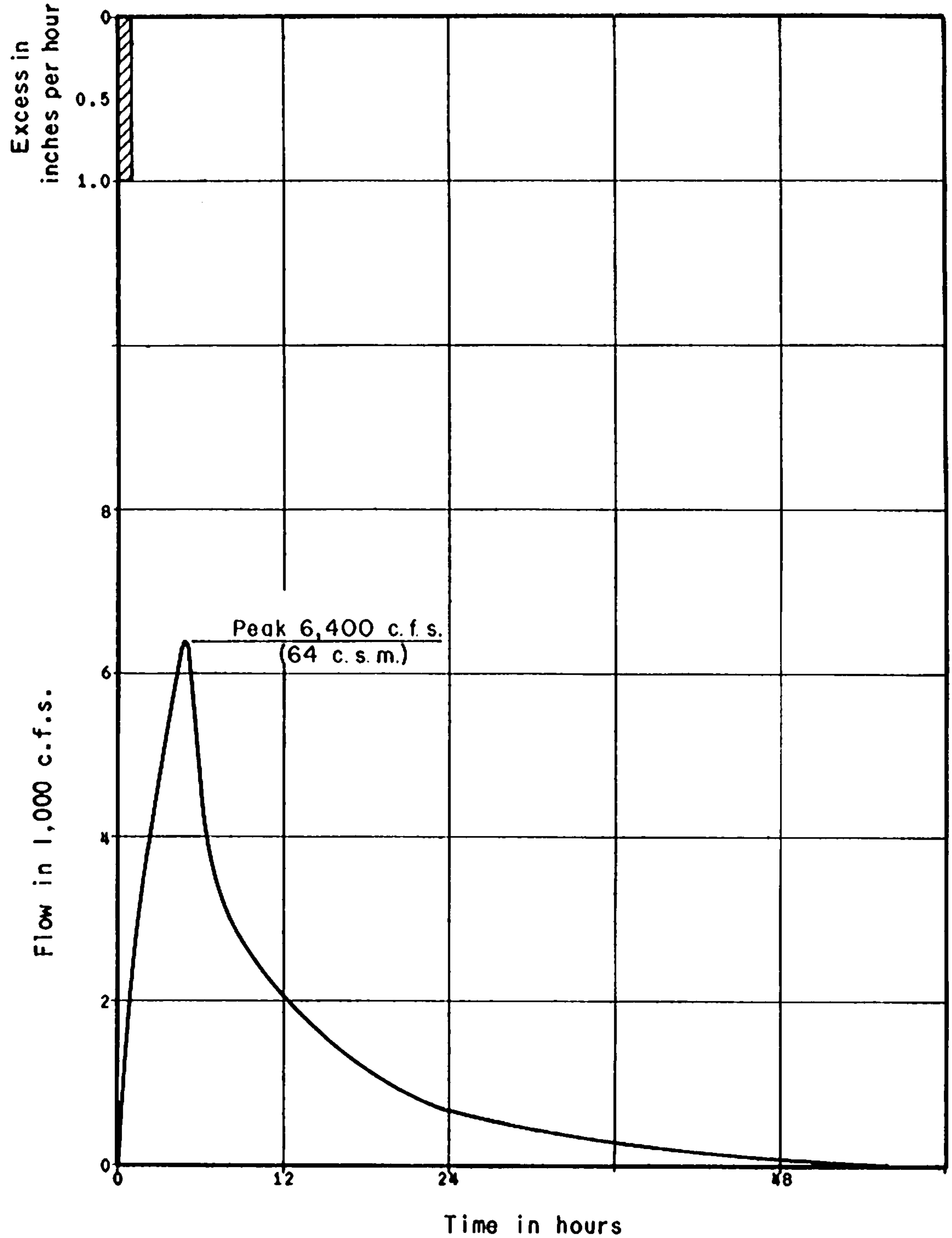
CACHE CREEK BASIN
CALIFORNIA

UNIT HYDROGRAPH
NORTH FORK CACHE CREEK
NEAR LOWER LAKE
INDEX POINT - 5

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: L.H.C.
Date: FEBRUARY 1974

CHART 16



DRAINAGE AREA	100.0 sq. mi.
$LL_{ca}/S^{.5}$	50.52
$\bar{n}$	0.070
Lag	7.46 hours
Peak	6,400 c.f.s.
Volume	64,533 1-hr.c.f.s.

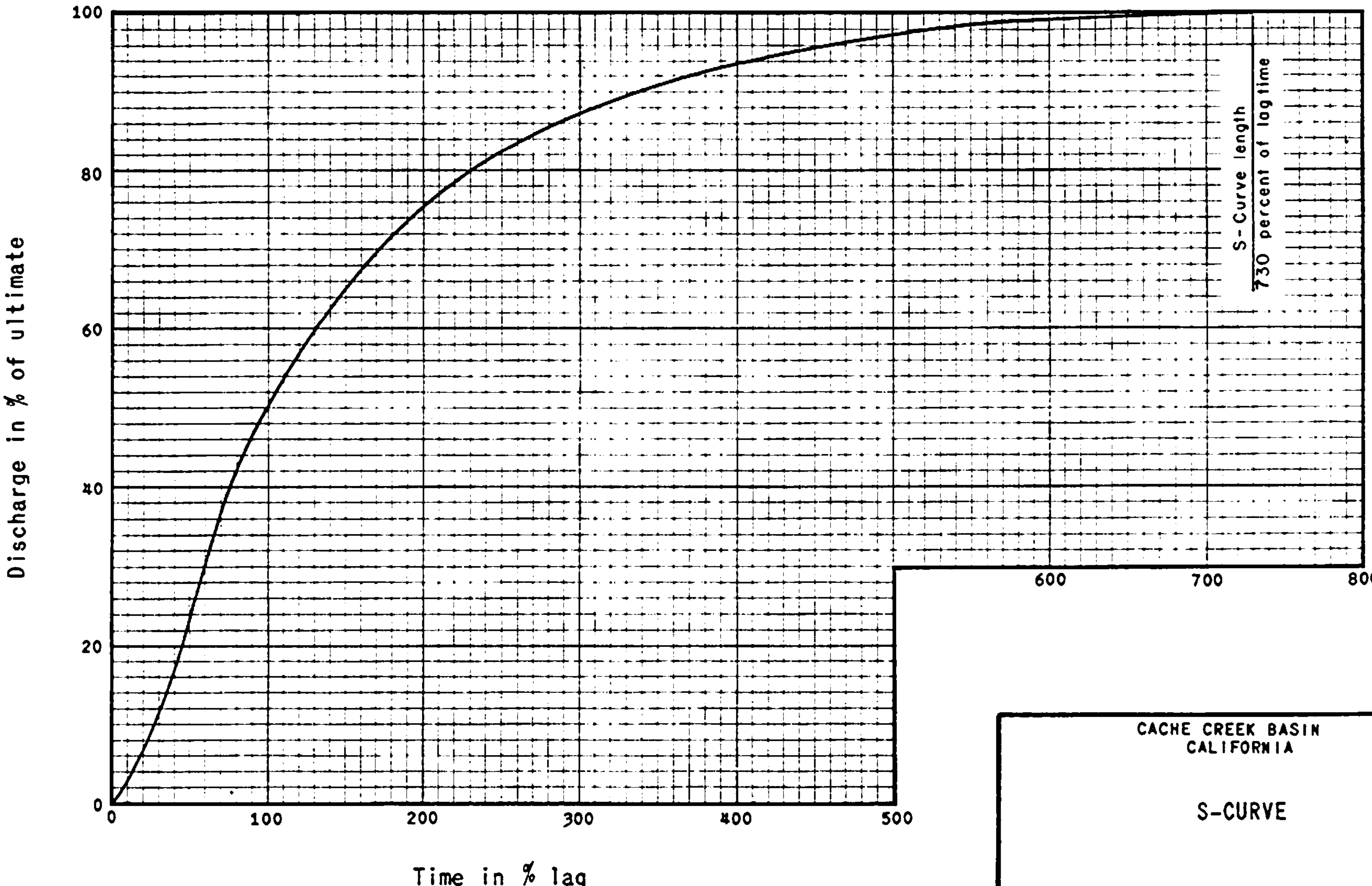
CACHE CREEK BASIN
CALIFORNIA

UNIT HYDOGRAPH
BEAR CREEK
NEAR RUMSEY GAGE
INDEX POINT - 6

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: L.H.C.
Date: FEBRUARY 1974

CHART 17



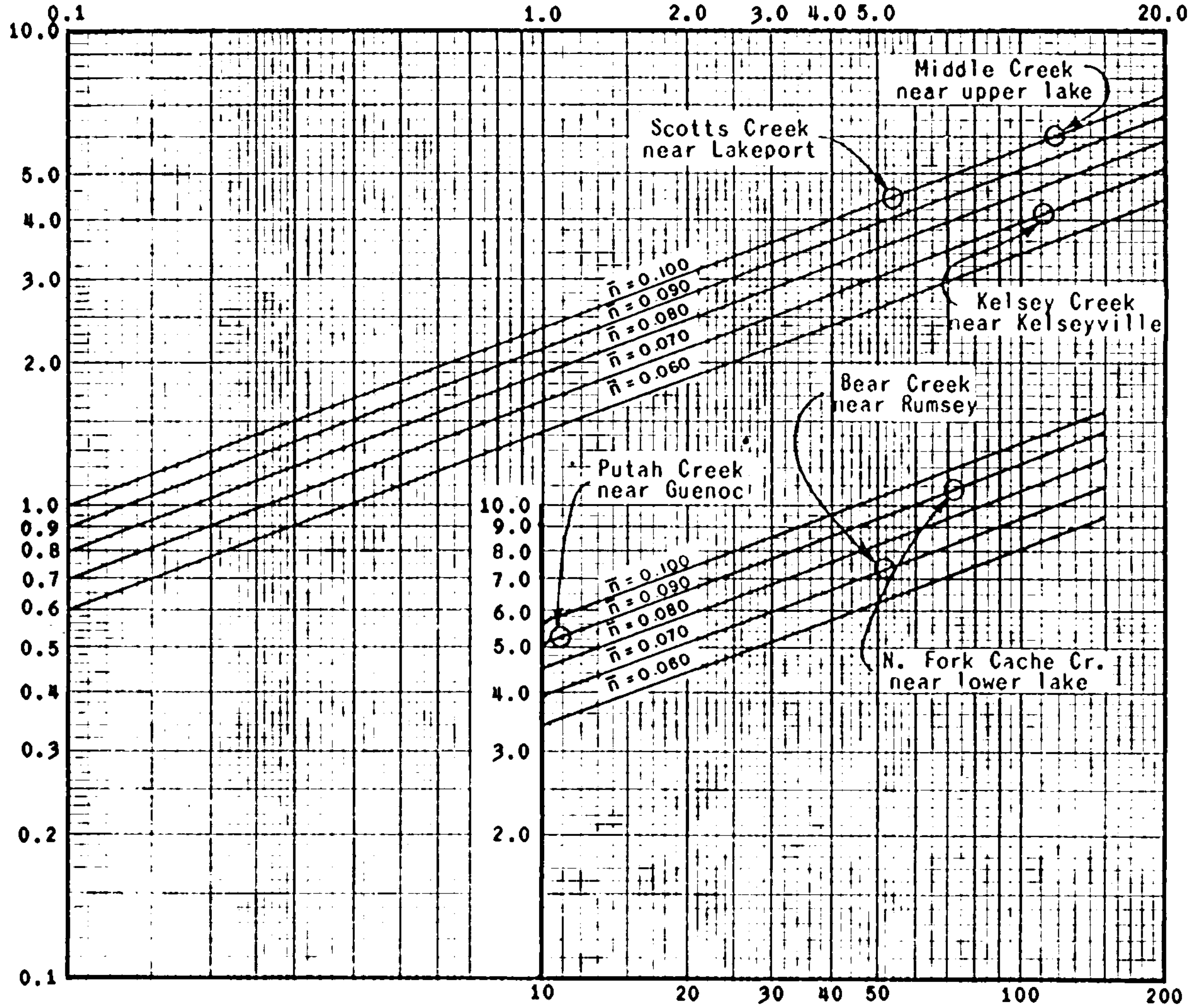
CACHE CREEK BASIN
CALIFORNIA

S-CURVE

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: M.A.S., L.H.C.
Date: FEBRUARY 1974

CHART 18



$$\frac{LL_{ca}}{S^{0.5}}$$

TERMINOLOGY

L	-	Length of longest watercourse.
L_{ca}	-	Length along longest watercourse, measured upstream to point opposite center of area.
S	-	Overall slope of longest watercourse between headwater and collection point.
Lag	-	Elapsed time from beginning of rain excess to instant that summation hydrograph reaches 50% of ultimate discharge.
n̄	-	Estimated mean of the n-values (Manning's) of all the channels within an area.

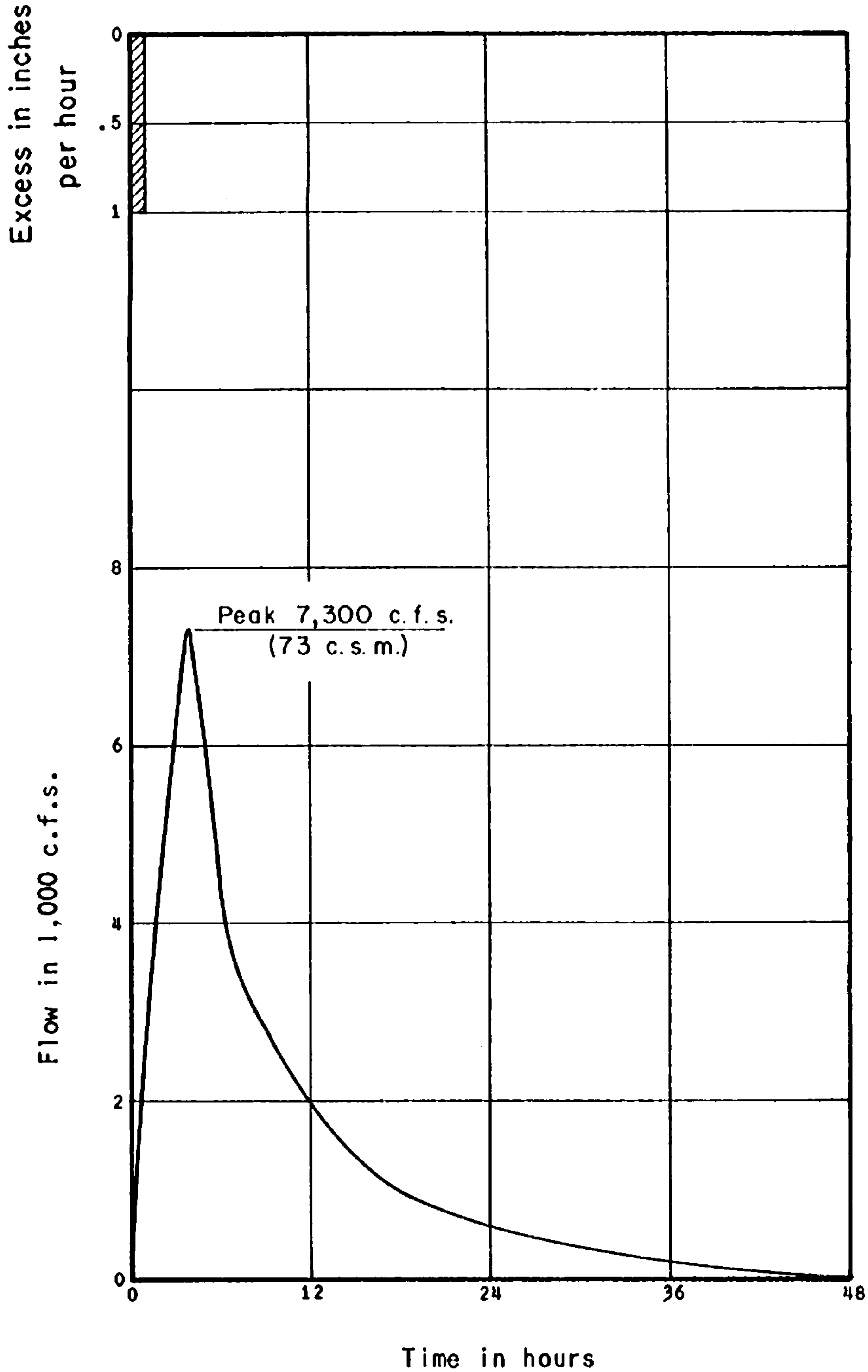
CACHE CREEK BASIN
CALIFORNIA

LAG RELATIONSHIPS

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drawn: H.A.S., L.H.C.
Date: FEBRUARY 1974

CHART 19



DRAINAGE AREA: 100 sq. mi.

CACHE CREEK BASIN
CALIFORNIA

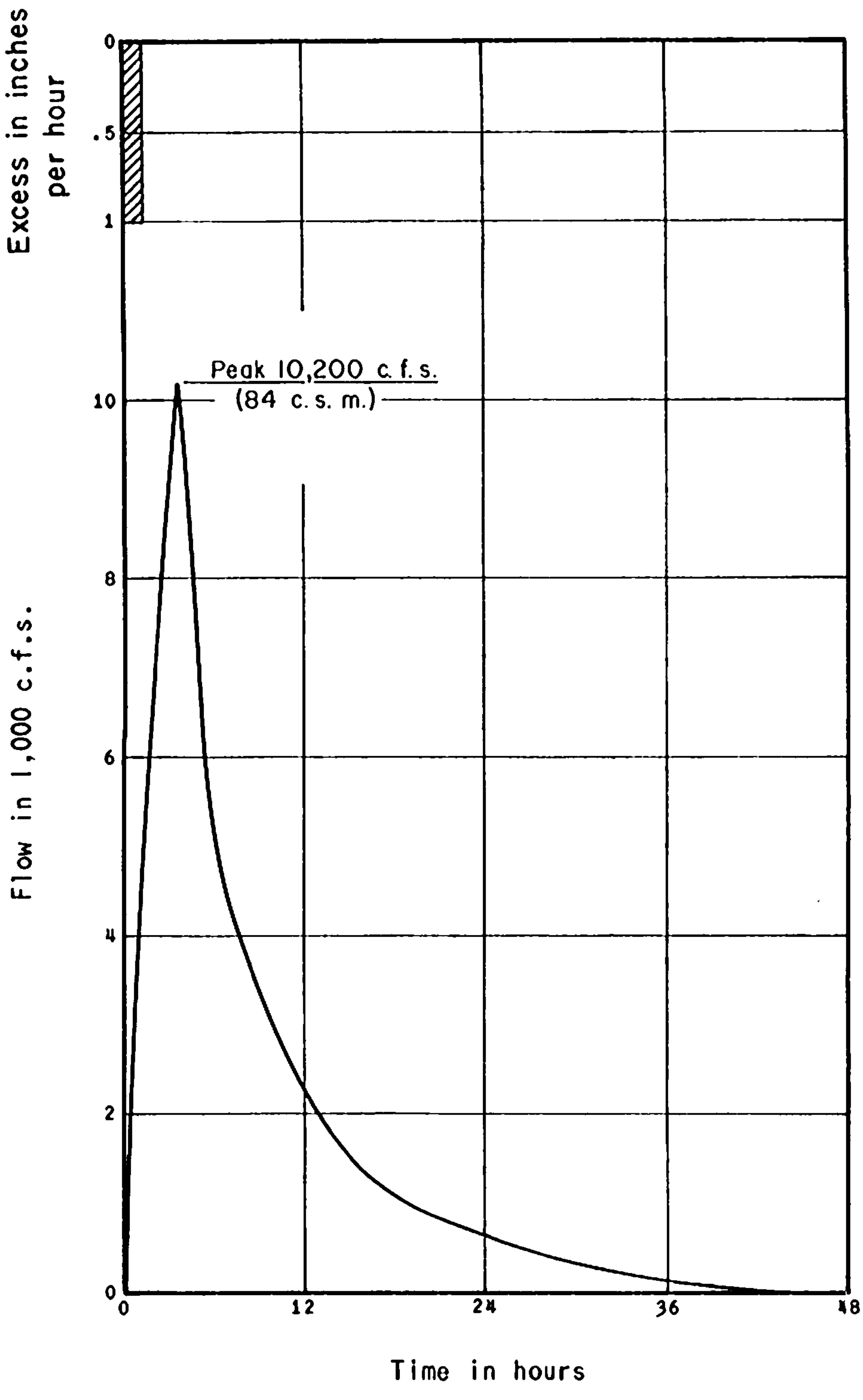
UNIT HYDROGRAPH-SPF
BEAR CREEK NEAR RUMSEY

INDEX POINT - 6

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P.W.
Drown: L.H.C.
Date: FEBRUARY 1974

CHART 20



DRAINAGE AREA : 121 sq. mi.

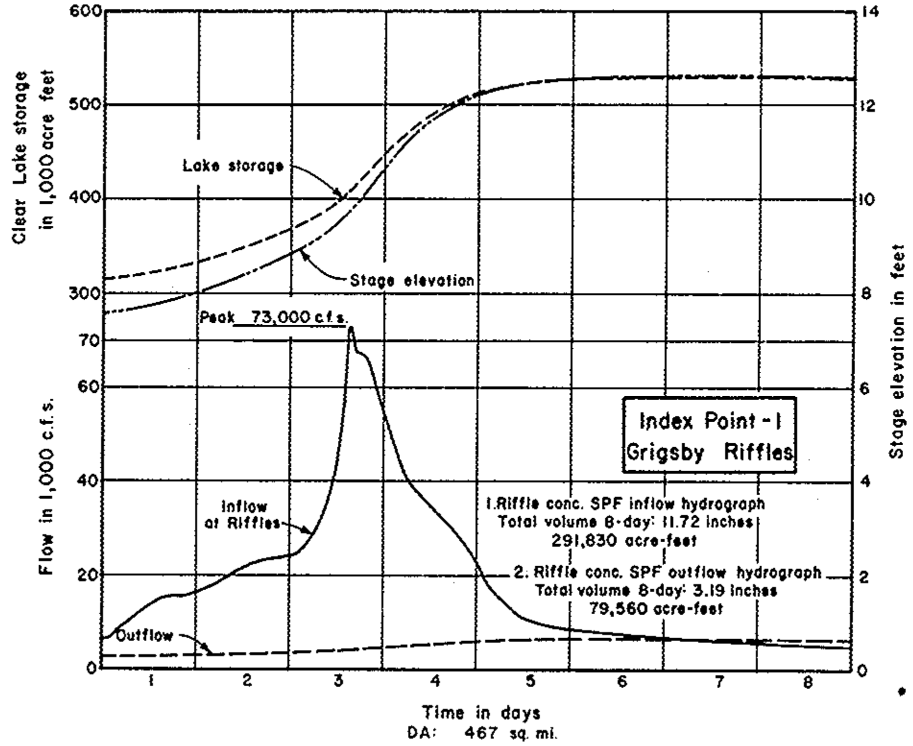
CACHE CREEK BASIN
CALIFORNIA

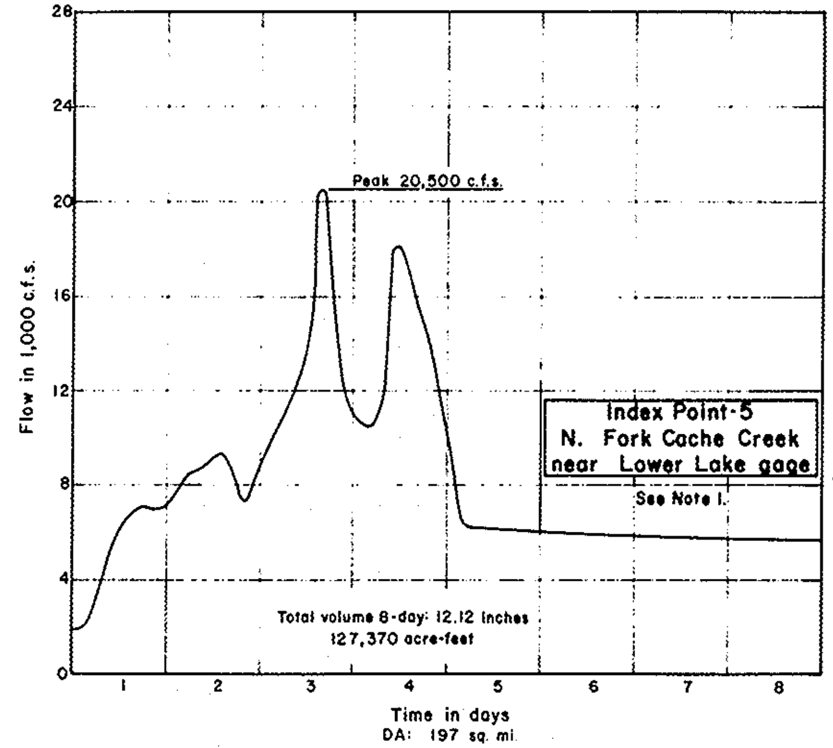
UNIT HYDROGRAPH - SPF
NORTH FORK CACHE CREEK AT
INDIAN VALLEY RESERVOIR
INDEX POINT - 4

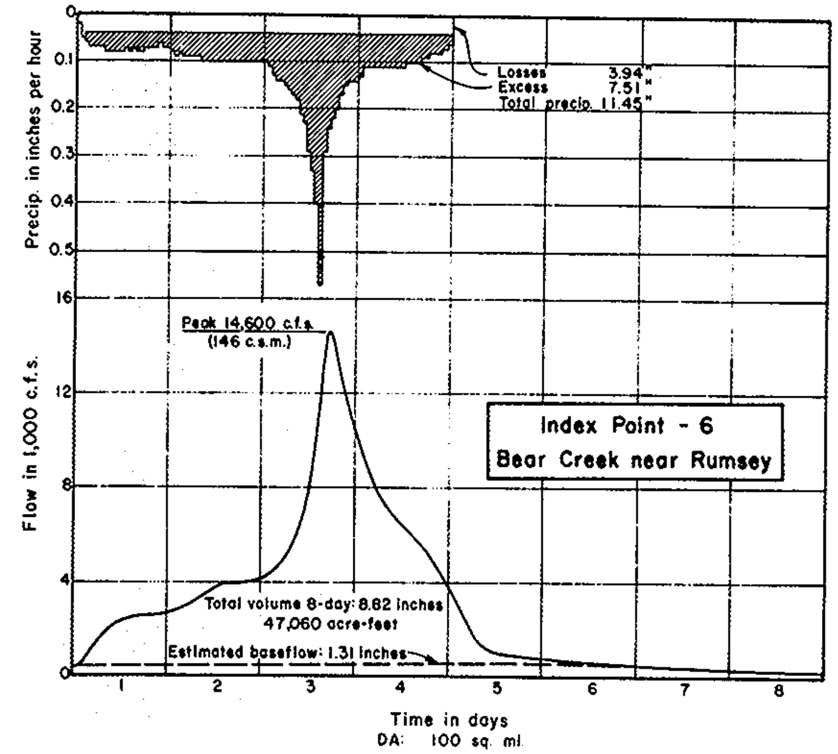
CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

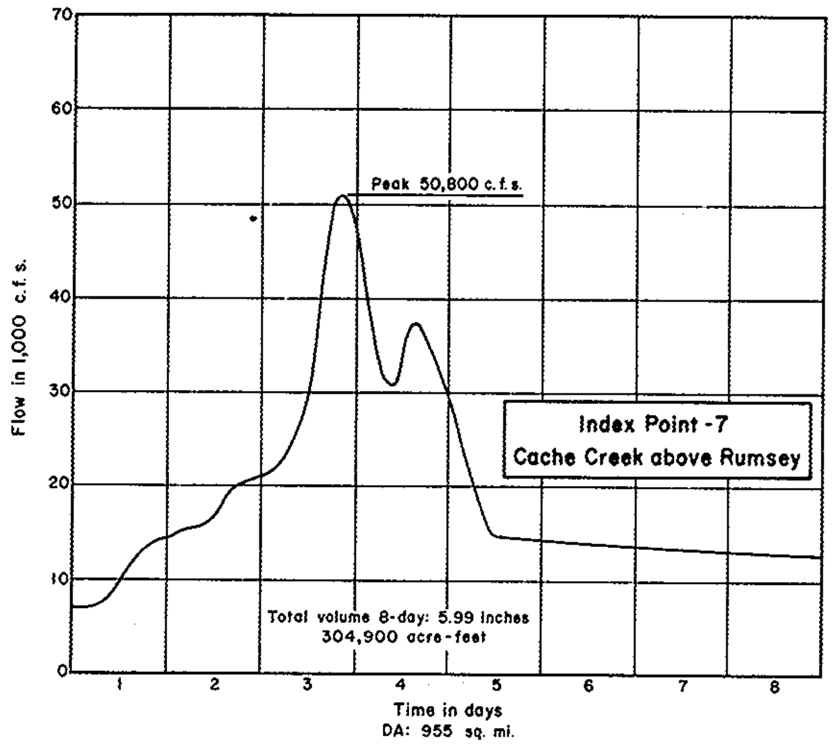
Prepared: P.W.
Drawn: L.H.C.
Date: FEBRUARY 1974

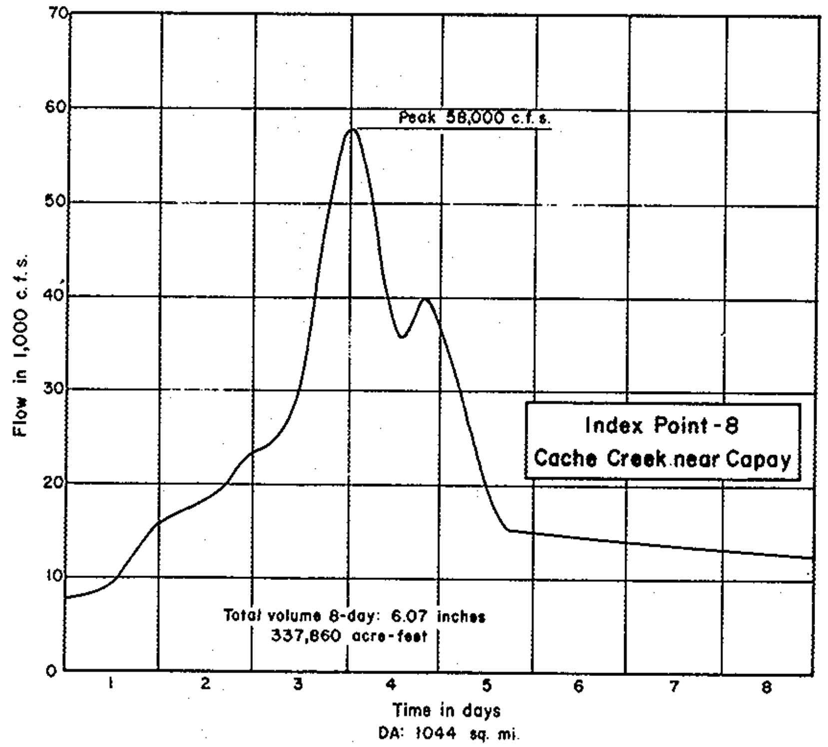
CHART 21

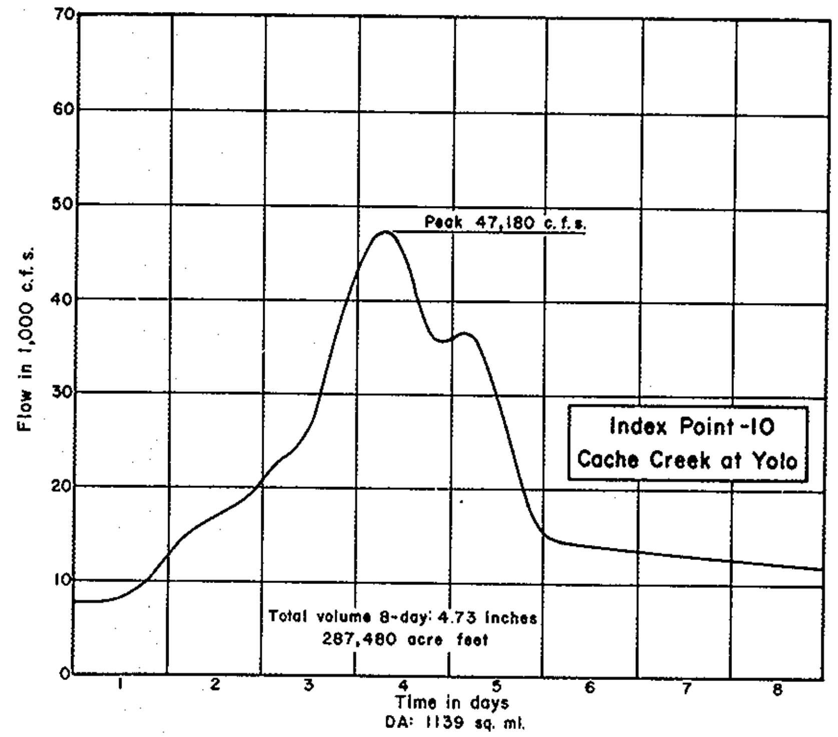












Note 1: Hydrograph is influenced by flood control operations of Indian Valley Reservoir.

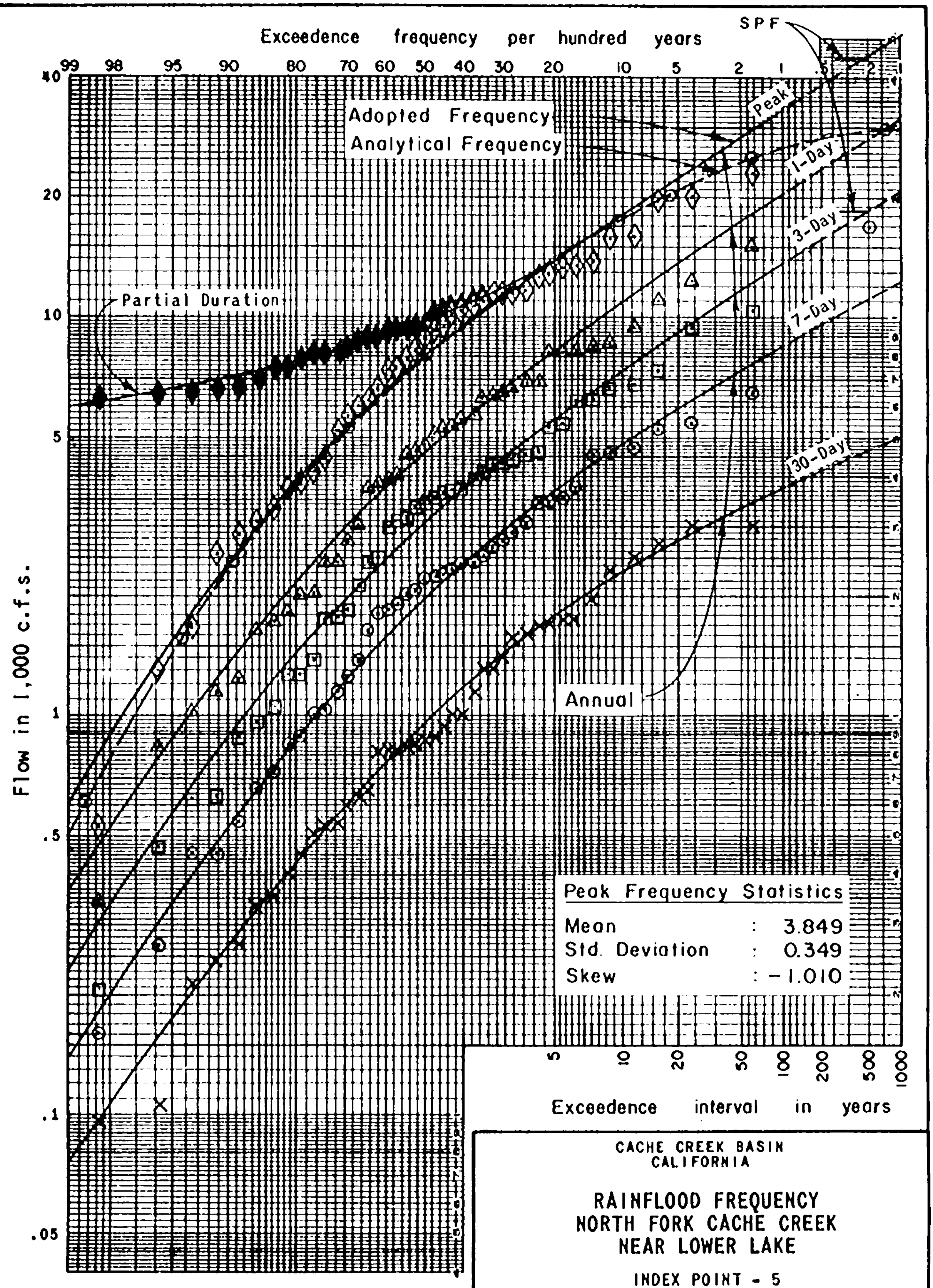
CACHE CREEK BASIN
CALIFORNIA

STANDARD PROJECT FLOOD HYDROGRAPHS
(PREPROJECT CONDITIONS)

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: P. W.
Drawn: L.H.C.
Date: FEBRUARY 1974

CHART 22



CACHE CREEK BASIN
CALIFORNIA

RAINFLOOD FREQUENCY
NORTH FORK CACHE CREEK
NEAR LOWER LAKE

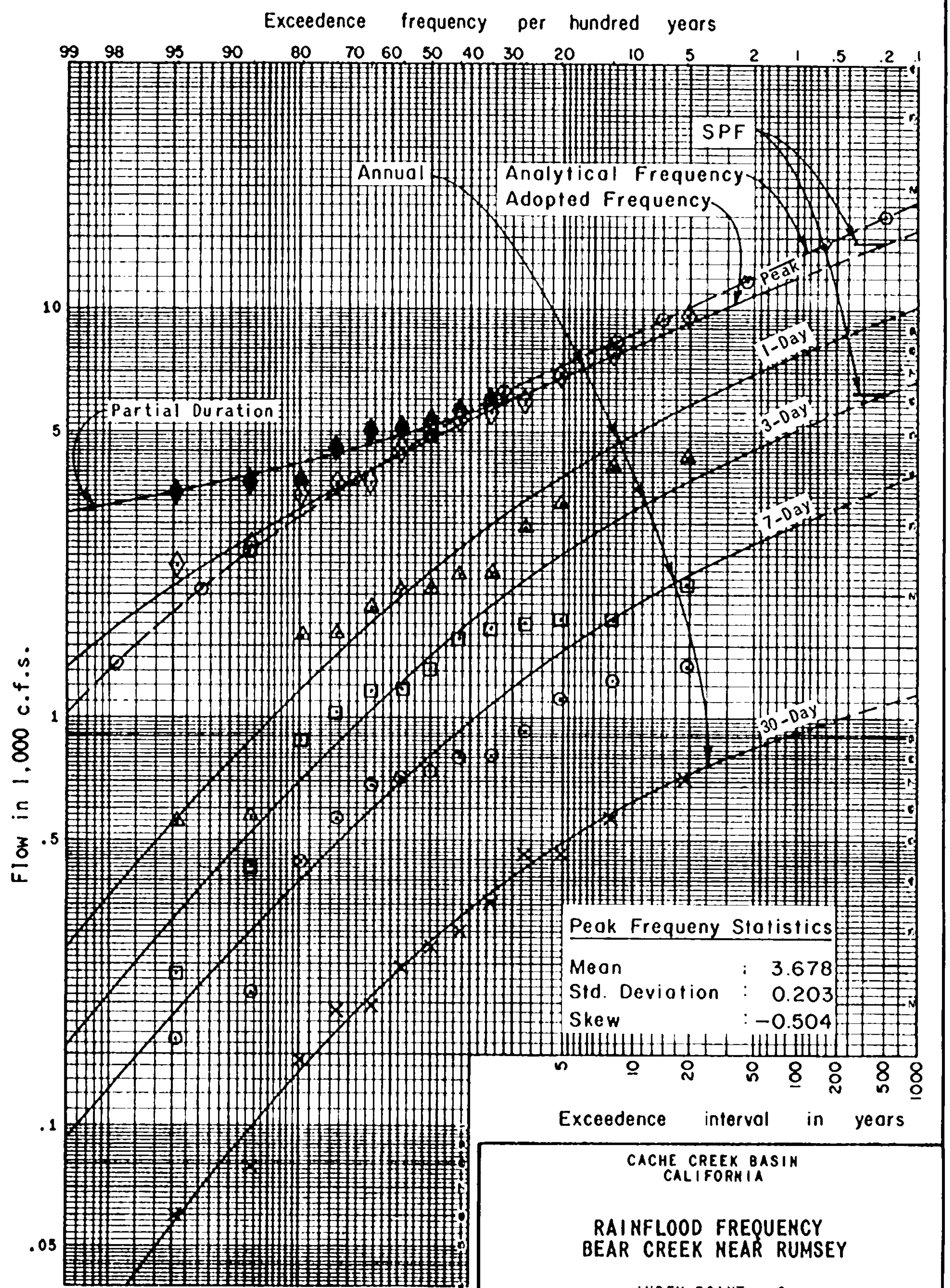
INDEX POINT - 5

DRAINAGE AREA: 197 sq. mi.

Period 1930-1971

Corps of Engineers, Sacramento, California

Prepared: P.W. Date: FEBRUARY 1974



CACHE CREEK BASIN
CALIFORNIA

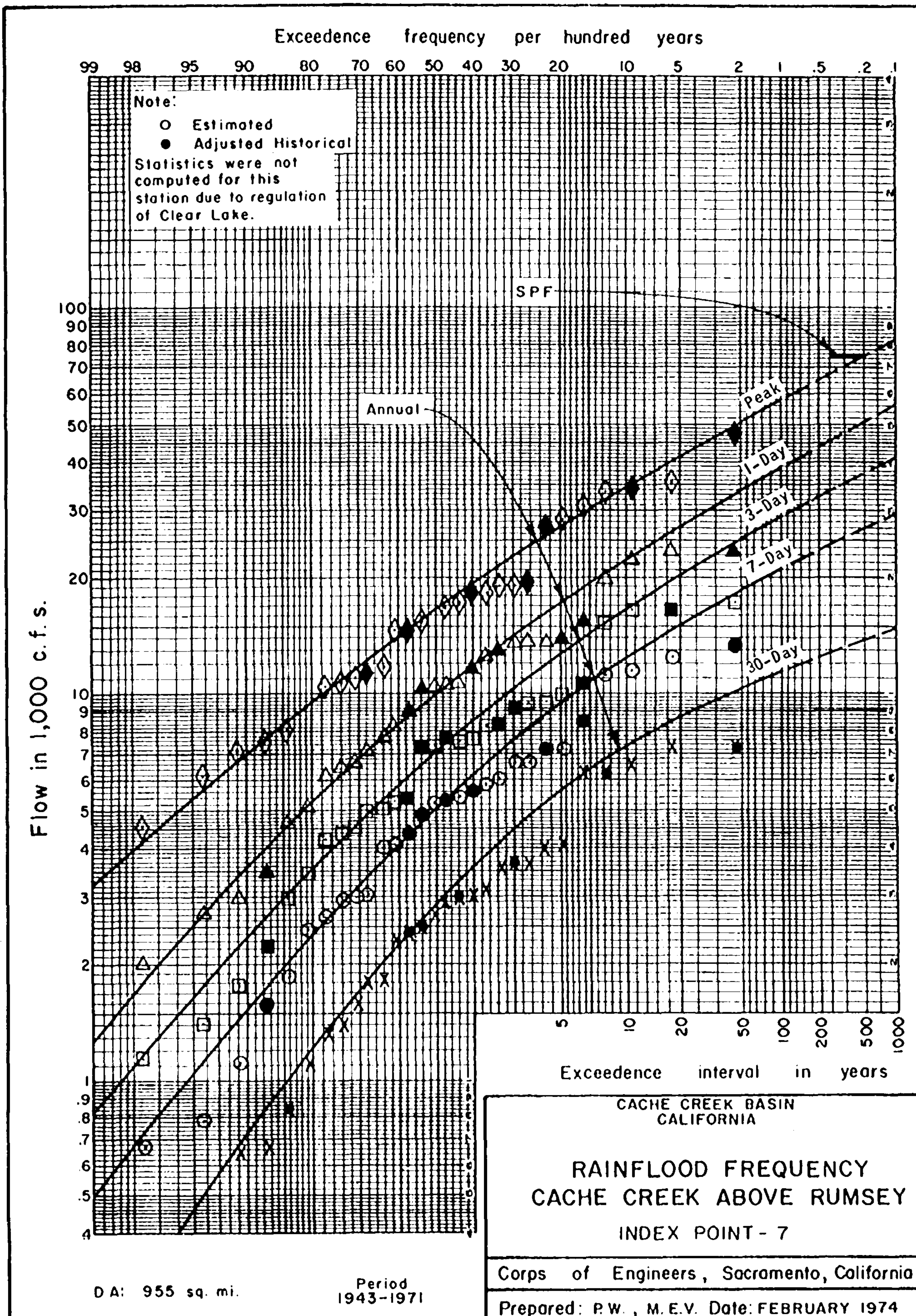
RAINFLOOD FREQUENCY
BEAR CREEK NEAR RUMSEY

INDEX POINT - 6

DRAINAGE AREA: 100 sq. mi. Period 1958-1971

Corps of Engineers, Sacramento, California

Prepared: P.W. Date: FEBRUARY 1974



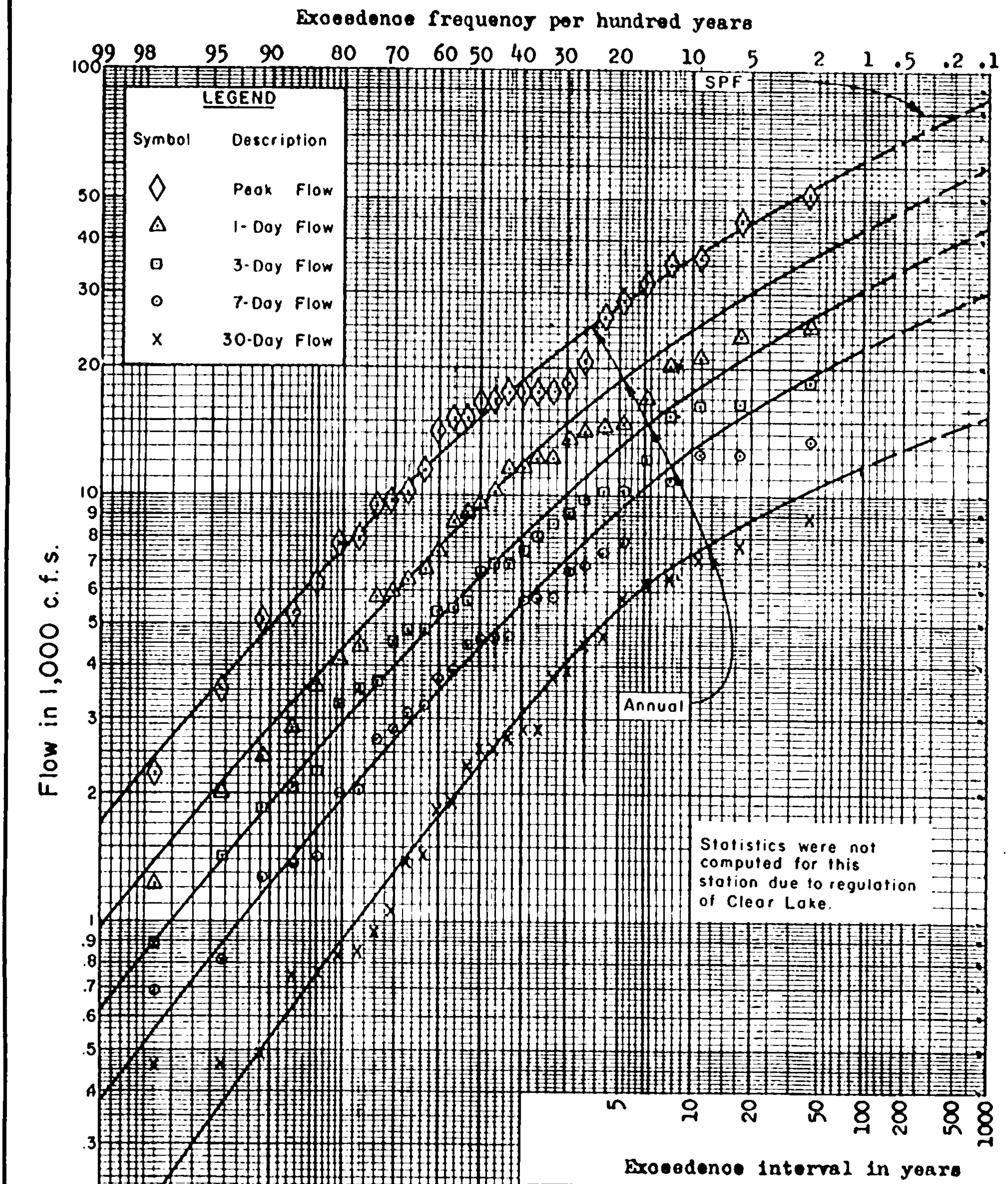
CACHE CREEK BASIN
CALIFORNIA

RAINFLOOD FREQUENCY
CACHE CREEK ABOVE RUMSEY

INDEX POINT - 7

Corps of Engineers, Sacramento, California

Prepared: P.W., M.E.V. Date: FEBRUARY 1974



CACHE CREEK BASIN
CALIFORNIA

RAINFLOOD FREQUENCY
CACHE CREEK NEAR CAPAY

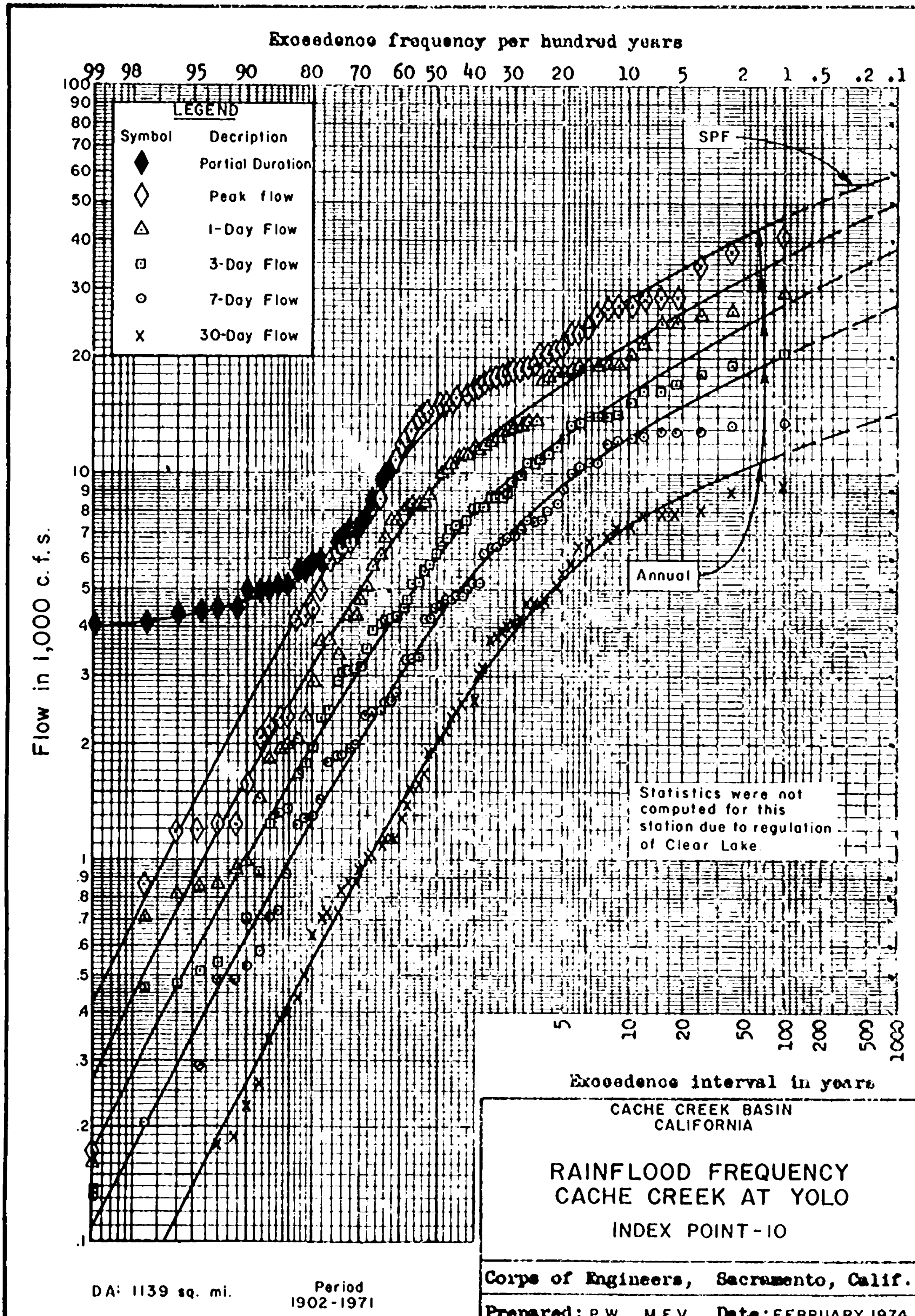
INDEX POINT - 8

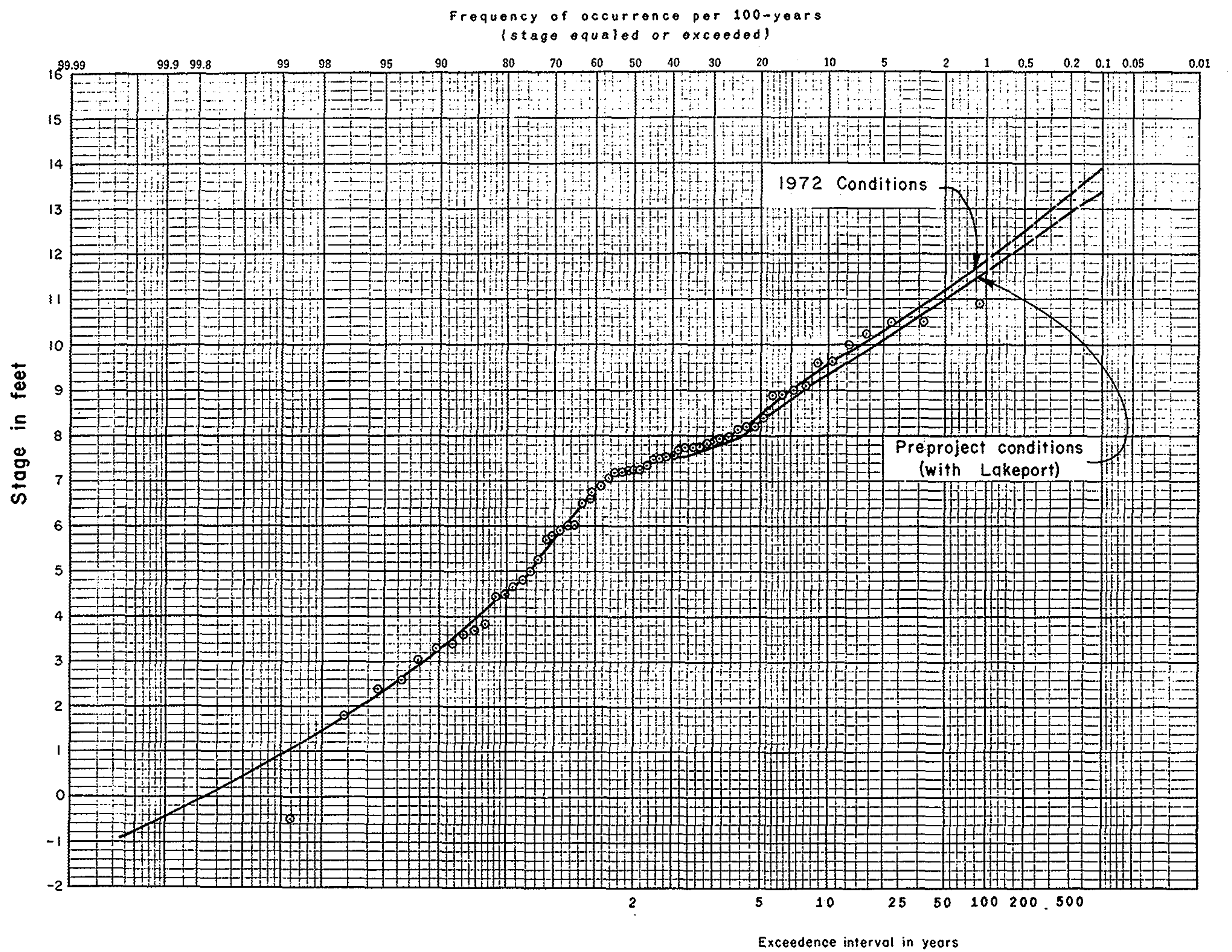
DA: 1044 sq. mi.

Period
1943-1971

Corps of Engineers, Sacramento, Calif.

Prepared: P.W., M.E.V. **Date:** FEBRUARY 1974


Exceedence frequency per hundred years
99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 .5 .2 .1
LEGEND
Symbol Decription
Partial Duration
Peak flow
1-Day Flow
3-Day Flow
7-Day Flow
X 30-Day Flow
SPF
Annual
Statistics were not computed for this station due to regulation of Clear Lake
Flow in 1,000 c.f.s.
100 90 80 70 60 50 40 30 20 10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2 .1
5 10 20 50 100 200 500 1000
Exceedence interval in years
DA: 1139 sq. mi.
Period
1902-1971
CACHE CREEK BASIN
CALIFORNIA
RAINFLOOD FREQUENCY
CACHE CREEK AT YOLO
INDEX POINT-10
Corps of Engineers, Sacramento, Calif.
Prepared: P.W., M.E.V. Date: FEBRUARY 1974



CACHE CREEK BASIN
CALIFORNIA

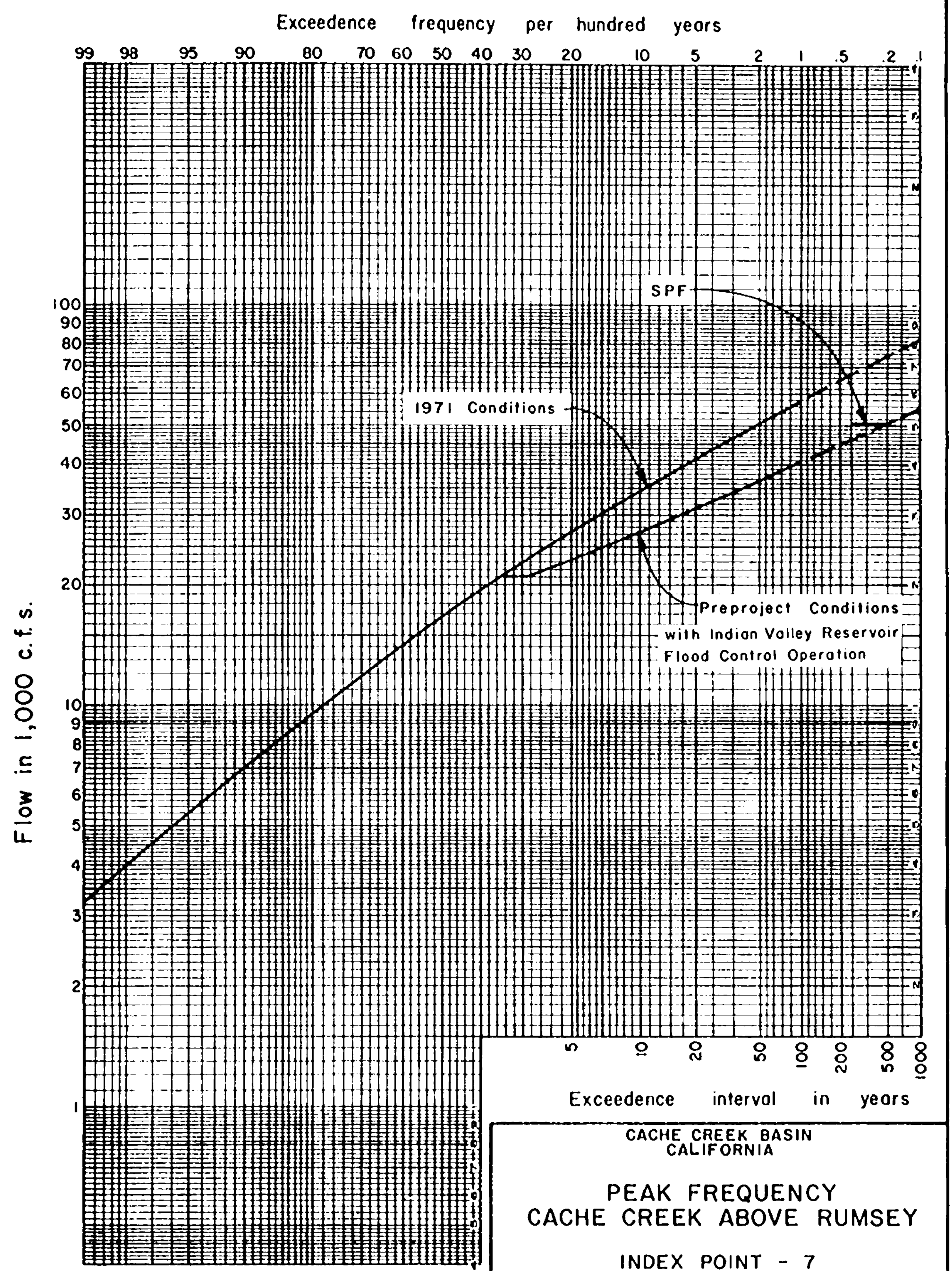
CLEAR LAKE
STAGE FREQUENCY

INDEX POINT - I

CORPS OF ENGINEERS, SACRAMENTO, CALIFORNIA

Prepared: M.E.V.
Drawn: L.H.C.

Date: FEBRUARY 1974



DA: 955 sq. mi.

Period
1943-1971

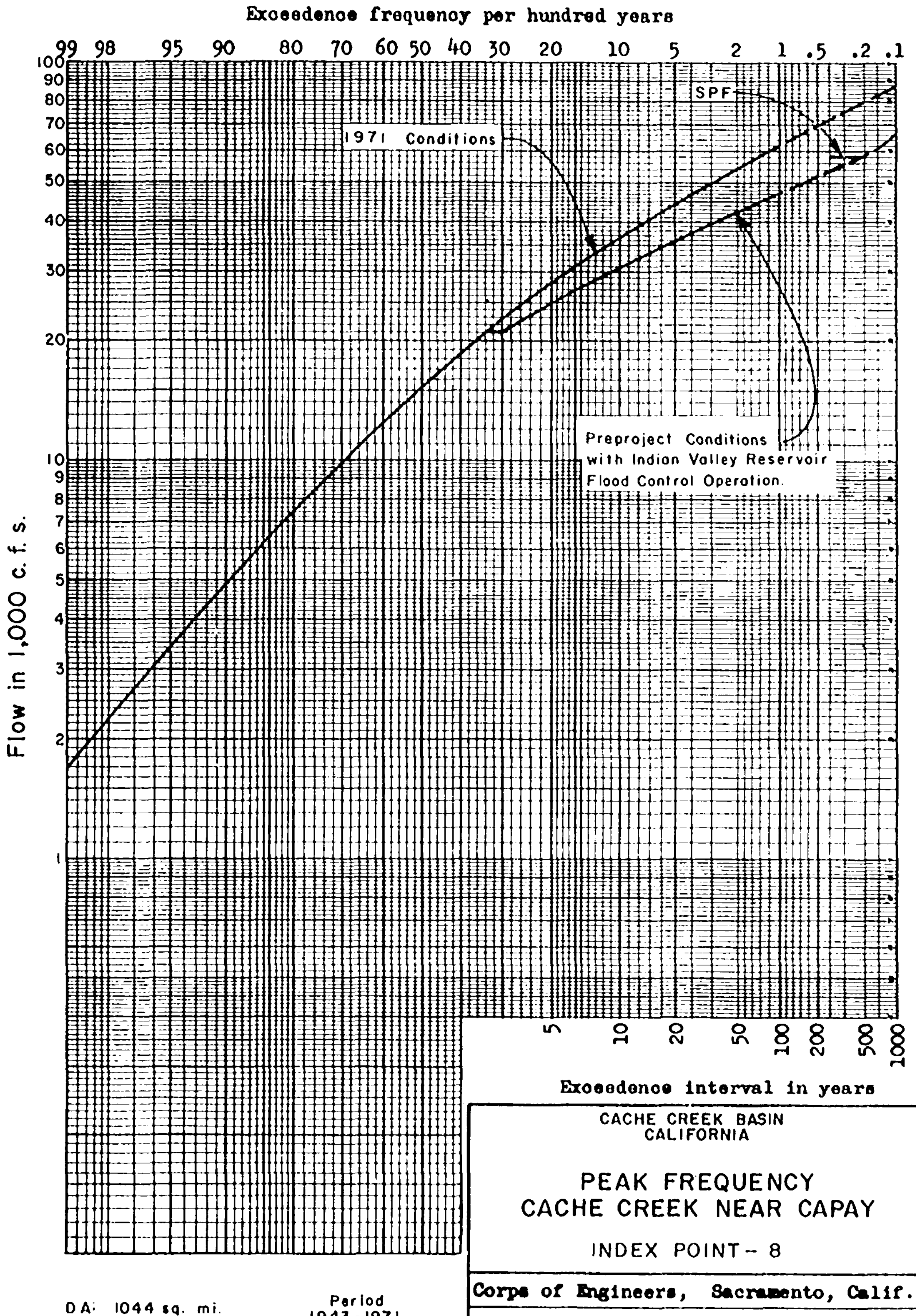
CACHE CREEK BASIN
CALIFORNIA

PEAK FREQUENCY
CACHE CREEK ABOVE RUMSEY

INDEX POINT - 7

Corps of Engineers, Sacramento, California

Prepared: P.W., M.E.V. Date: FEBRUARY 1974



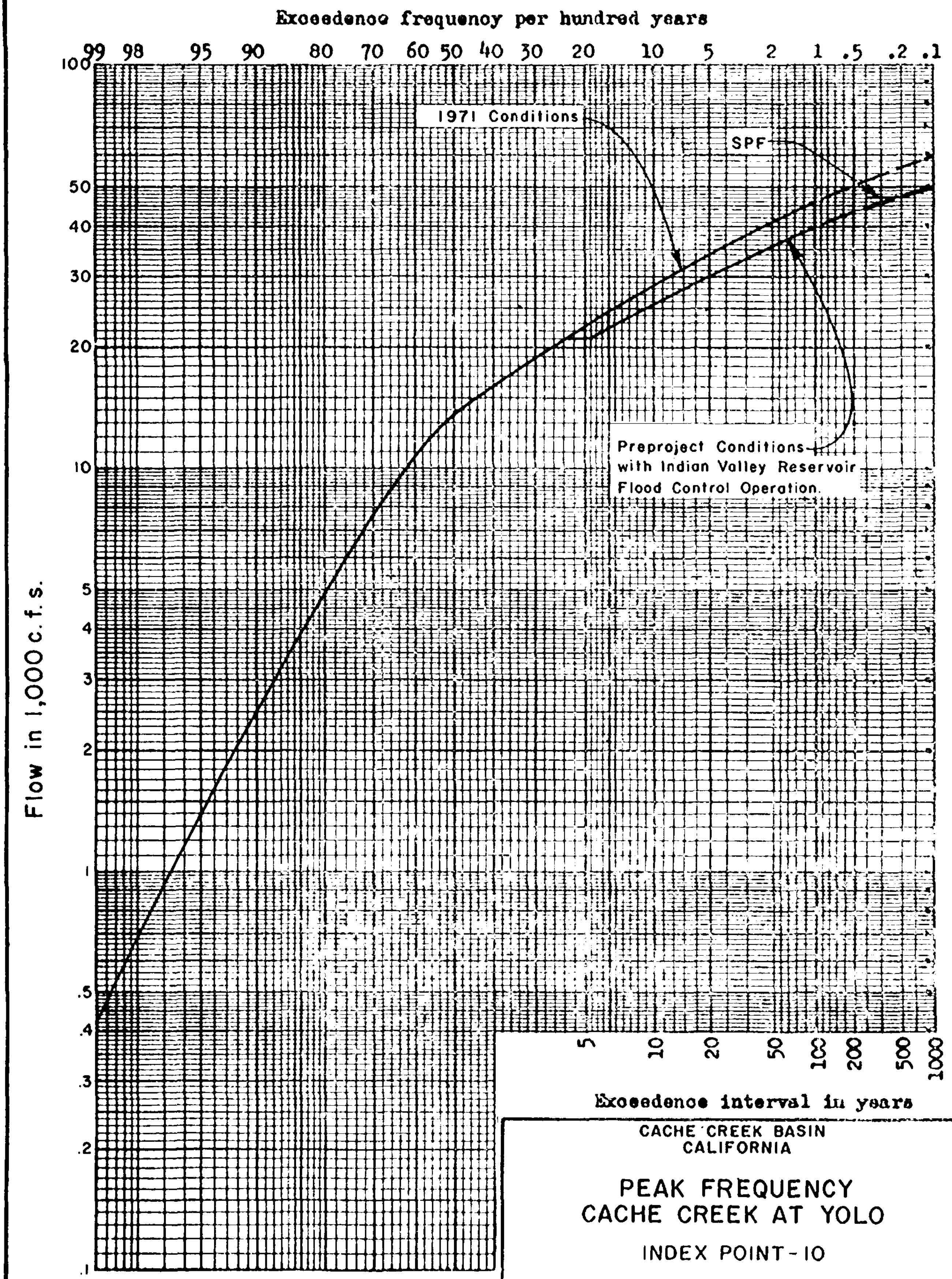
CACHE CREEK BASIN
CALIFORNIA

PEAK FREQUENCY
CACHE CREEK NEAR CAPAY

INDEX POINT – 8

Corps of Engineers, Sacramento, Calif.

Prepared: P.W., M.E.V Date: FEBRUARY 1974



CACHE CREEK BASIN
CALIFORNIA

PEAK FREQUENCY
CACHE CREEK AT YOLO

INDEX POINT - 10

Corps of Engineers, Sacramento, Calif.

Prepared: P. W., M.E.V **Date:** FEBRUARY 1974